

November 24, 2014

Mote & Associates  
214 W. Fourth Street  
Greenville, OH 45331

Attention: Mr. Mike Bruns, P.E.

Reference: Subgrade Exploration – Final Submittal  
West Fourth / Sweitzer Street Reconstruction  
PID No. 97246  
Greenville, Ohio – Darke County  
CTL Project No.: 14050043WAP

Mr. Bruns:

CTL Engineering, Inc. has completed the Subgrade Exploration for the above referenced project. Enclosed is a copy of the report and appendices.

Thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office.

Respectfully Submitted,

**CTL ENGINEERING, INC.**



Frederick Schoen, P.E.  
Project Engineer

FLS/fls

1c. Bruns, Mike (Mote) – [mbruns@moteandassociates.com](mailto:mbruns@moteandassociates.com)

# **SUBGRADE EXPLORATION REPORT**

*FINAL SUBMITTAL*

## **W. FOURTH / SWEITZER STREET** **RECONSTRUCTION**

**GREENVILLE, OHIO**  
**ODOT PID #97246**

**CTL PROJECT NO.: 14050043WAP**

*PREPARED FOR:*

**MOTE AND ASSOCIATES, INC.**  
**214 WEST FOURTH STREET**  
**GREENVILLE, OHIO 45331**

*PREPARED BY:*

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**NOVEMBER 24, 2014**



**RECORD OF REVISIONS**

<b>Date of Transmittal</b>	<b>Description</b>	<b>Remarks</b>
8/15/2014	Submittal of Preliminary Data	Precursor to Draft Report
8/29/2014	Submittal of Draft Report	--
11/24/14	Submittal of Final Report	Added Hand Augered Borings

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## I. EXECUTIVE SUMMARY

The project, West Fourth/Sweitzer Street Reconstruction, is the full-depth reconstruction and slight widening of approximately 2,750 linear feet of existing roadway. Sweitzer Street, starting at its intersection with Pine Street at Station 0+00 continues northward to near Station 14+10 where Sweitzer Street makes approximately a 52 degree bend in forming West Fourth Street. West Fourth Street continues eastward from the bend to Station 27+50, at its intersection with Sycamore Street.

The new roadway profile requires only minor cut (less than 0.5 feet) and minor fill (less than 0.5 feet) to establish the proposed grade. The horizontal alignment of the roadway will remain unchanged. The roadway does cross an existing railroad spur operated by R.J. Corman near Station 7+50.

Eleven (11) soil test borings were drilled and two (2) hand augerings were performed for the subsurface exploration. Below the surface materials, the borings exhibited a variety of soil types that were identified as being predominately damp to moist and included gravel and/or stone fragments (A-1-a), gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), gravel and/or stone fragments with sand, silt and clay (A-2-6), fine to coarse sand (A-3a), sandy silt (A-4a), silt and clay (A-6a), silty clay (A-6b) and clay (A-7-6) soils. Soils found in the upper several feet of borings were sometimes identified as being previously placed fill materials that included asphalt fragments, slag, and cobbles. No bedrock was encountered in the borings. Groundwater was only recorded in boring B-005-0-14 at a depth of 17.0 feet below existing surface grade, which corresponds to elevation 1022.6 feet.

CTL Engineering performed a document search of the Ohio Department of Transportation (ODOT) Geotechnical Data Management System (GeoMS) for historical records. No geotechnical records were found to be available for review.

Subgrade soils throughout the project are suspected to require undercutting and replacement; or chemical stabilization with cement or lime-kiln dust.

A California Bearing Ratio (CBR) value of 8.0 percent may be used for pavement thickness design on this project.

The various segmental block retaining walls constructed throughout the project may utilize a calculated factored bearing resistance 2.2 ksf. This value is based on the strength limit state of the bearing soils and assumes a resistance factor of 0.45.

## **II. INTRODUCTION**

The project, West Fourth/Sweitzer Street Reconstruction, is the full-depth reconstruction and slight widening of approximately 2,750 linear feet of existing roadway. Sweitzer Street, starting at its intersection with Pine Street at Station 0+00 continues northward to near Station 14+10 where Sweitzer Street makes approximately a 52 degree bend in forming West Fourth Street. West Fourth Street continues eastward from the bend to Station 27+50, at its intersection with Sycamore Street.

The new roadway profile requires only minor cut (less than 0.5 feet) and minor fill (less than 0.5 feet) to establish the proposed grade. The horizontal alignment of the roadway will remain unchanged. The roadway does cross an existing railroad spur operated by R.J. Corman near Station 7+50.

A result of maintaining the design dimensions for the width of the reconstructed street, curbs, and sidewalks; several existing retaining walls will likely have to be removed and rebuilt, which are located in the front yards of numerous homes along the route. These small retaining walls will be reconstructed where needed due to the new right-of-way cutting into the existing terrain and/or instability of the existing walls. New wall heights are not expected to be greater than 7.5 ft in height.

## **III. GEOLOGY AND OBSERVATIONS OF THE PROJECT**

Surface soils across the project include Miamian silt loam with 2 to 6 percent slopes (MmB), and Crosby silt loam with 0 to 2 percent slopes (CrA), both of which are very deep, well to somewhat poorly drained soils.

Darke County lies within the Silty Loam Till Plain section of the Central Lowlands Physiographic Province of Ohio and the project site is located in a region where sand and gravel deposits are typically interbedded in glacial till. Before and during the Pleistocene Epoch, several glacial events occurred in west-central Ohio. Most recently, the Wisconsin ice sheet covered all of Darke County, and most of northern Ohio. The regional area includes deposits of (glacial) till, outwash, and ice-contact sand and gravels (kames and eskers). Most of the surficial glacial deposits of Darke County are in the form of end moraines or till plains (ground moraines), including the project site. The Union City End Moraine is located a few miles north of the site and divides Greenville with topography being gently rolling to hummocky and consisting of the Woodington glacial till unit located north of Greenville and the Arcanum glacial till unit located to the south. The till deposits were deposited discontinuously by ice advancing over older glacial deposits or bedrock and consist of varying percentages of clay, silt, sand, and gravel. The site is also within the geomorphic “Boulder Belt of Western Ohio”, which consists of a region of land having a high concentration of surface and subsurface cobbles and boulders.

The Greenville area is underlain by sedimentary rock of Lower Silurian and Ordovician Age. The project site resides directly over the Silurian age Lockport Dolomite; and is immediately adjacent to a tributary of a pre-historic Teays Stage or Deep Stage river. The pre-historic river drained the southern and western two thirds of Ohio prior to or during the state being glaciated. This river, and its tributaries, had cut deep valleys into the underlying rock, which has since been filled in with glacial overburden. The rock floor within the buried valleys is known to be up to several hundred feet lower in elevation than the adjacent areas. It is thought that at the rock surface below the project site, the Lockport Dolomite is expected to be at depths near 140 feet below existing surface grades. No known karst or underground mine related incidents exist at the project site.

Several trips to the site have been made during this exploration. Site conditions observed were similar at each occurrence. The existing roadway is a two-lane, bi-directional roadway. The road surface consists of asphalt concrete that was found to exhibit minor wheel path depressions, isolated areas of light to heavy cracking, and a few potholes. The road surface is relatively level or slightly depressed in comparison to the land surrounding the roadway. Storm water collection features drain the existing road. Land usage outside of the roadway is primarily residential homes, with a known business, public service building, and church located between Central Avenue and Sycamore Street.

Prominent data contained in the preceding paragraphs were obtained from the sources listed below:

- *Ohio Department of Natural Resources, Division of Geological Survey, Bedrock Geology (BG-1) Map, 1:500,000 Scale, Bedrock Geology Map of Ohio, 2006*
- *Ohio Department of Natural Resources, Division of Geological Survey, Bedrock Geology (BG-4a) Map, 1:24,000 Scale, Bedrock Topography of the Greenville West Quadrangle, photoinspected 1980*
- *Ohio Department of Natural Resources, Division of Geological Survey, Environmental Geology (EG-1) Map, 1:2,000,000 Scale, Known and Probable Karst in Ohio, 1999 (rev. 2002, 2006)*
- *Ohio Department of Natural Resources, Division of Geological Survey, Environmental Geology (EG-3) Map, Known Abandoned Underground Mines of Ohio*
- *Ohio Department of Natural Resources, Division of Geological Survey, Surface Geology (SG-1) Map, 1:500,000 Scale, Quaternary Geology of Ohio, 2004*
- *Ohio Department of Natural Resources, Division of Geological Survey, Surface Geology (SG-2) Map, Surficial Geology of the Ohio Portion of the Piqua 30 x 60 Minute Quadrangle, 2011*
- *Ohio Department Natural Resources, Division of Water, Water Resources Section, Groundwater Pollution Potential of Darke County, Ohio, 1991*
- *Ohio Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey, Soil Map – Darke County, Ohio*
- *Ohio Department of Natural Resources, Division of Geological Survey, Bulletin 44, Geology of Water in Ohio, 1943*
- *Ohio Department Natural Resources, Division of Water, Water Resources Section, Water Well Logs of Darke County, Ohio*

#### **IV. EXPLORATION**

Eleven (11) soil test borings, identified as B-001-0-14 through B-011-0-14, were drilled and two (2) hand augerings, H-004-1-14 and H-005-1-14, were performed for the subsurface exploration. Borings were drilled within of the existing pavement while alternating left and right of the existing roadway centerline and avoiding underground utilities. Test borings were extended through the existing pavement materials, and into the soil subgrade to depths of 10.0 to 20.0 feet below existing surface grades. Hand augerings were performed in the front yards of two residential homes, which are located behind the planned retaining walls for the project. They were extended to depths of 6.5 to 7.5 feet below existing grades.

CTL Engineering performed a document search of the Ohio Department of Transportation (ODOT) Geotechnical Data Management System (GeoMS) for historical records. No geotechnical records were found to be available for review.

Test borings were advanced utilizing a truck mounted drill rig with 3.25-in. inside diameter hollow-stem augers (HSA). Standard Penetration Tests were conducted in the test borings using an automatic 140-pound hammer falling 30 inches to drive a 2-inch O.D. split-spoon sampler for 18 inches. The drill rig's hammer was previously calibrated on September 24, 2013, and has a drill rod energy ratio of 84.4 percent.

Split spoon soil samples were obtained continuously from below the surface cover to a depth of 7.0 feet in each boring. Subsequent samples were then obtained between depths of 8.5 and 10.0 or 20.0 feet at 2.5-foot intervals.

Soil samples obtained from drilling operations were preserved in glass jars, visually classified in the field and laboratory, and tested for natural moisture content. Representative samples were subjected to laboratory testing including grain size analysis, atterberg limits, sulfate content, and hand penetrometer.

Stations, offsets and ground surface elevations at borings locations were provided to CTL Engineering (CTL) by Mote and Associates (Mote). State Plane northings and eastings for boring locations were also provided to CTL by Mote. These northings and eastings were converted to latitude and longitude coordinates using "Corpscon6" computer software, which was released by the U.S. Army Corps of Engineers.

#### **V. FINDINGS**

The test borings were drilled within the existing roadway and encountered 3 to 6 inches of asphalt pavement materials. Supporting the asphalt, borings B-001-0-14, B-002-0-14, and B-004-0-14 encountered a layer of brick; else, borings encountered 5 to 8 inches of crushed aggregate subbase materials.



Below the surface materials, the borings exhibited a variety of soil types that were identified as being predominately damp to moist and included gravel and/or stone fragments (A-1-a), gravel and/or stone fragments with sand (A-1-b), gravel and/or stone fragments with sand and silt (A-2-4), gravel and/or stone fragments with sand, silt and clay (A-2-6), fine to coarse sand (A-3a), sandy silt (A-4a), silt and clay (A-6a), silty clay (A-6b) and clay (A-7-6) soils. Soils found in the upper several feet of borings were sometimes identified as being previously placed fill materials that included asphalt fragments, slag, and cobbles. No bedrock was encountered in the borings.

Groundwater was only recorded in boring B-005-0-14 at a depth of 17.0 feet below existing surface grade, which corresponds to elevation 1022.6 feet.

## **VI. ANALYSES AND RECOMMENDATIONS**

Based on plans provided by Mote, the new roadway profile requires only minor cut (less than 0.5 feet) and minor fill (less than 0.5 feet) to establish the proposed grade. The horizontal alignment of the roadway will remain unchanged. The existing two-lane road is being slightly widened along both sides of the road to accommodate new curbs and sidewalks.

Based upon the subsurface information obtained from the field and laboratory testing, the following recommendations are provided.

### **A. Subgrade Considerations**

A subgrade analysis was performed utilizing the subsurface information from the drilled borings along with ODOT GB1 guidelines. Soils deeper than 6 feet below the proposed subgrade were excluded from the GB1 spreadsheet.

Optimum Moisture Content (OMC) values for the near surface (subgrade) samples were estimated using procedures outlined in ODOT's GB1. The natural moisture content values of the near surface soil samples ranged from 3 to 28 percent, averaging 12.7 percent. The estimated OMC values ranged from 6 to 18 percent, averaging 11.3 percent. Soils also exhibited plasticity index (PI) values ranging from 4 to 37 percent, averaging a value of 14.1 percent.

Group Index values were calculated for each of the subgrade samples tested. Group Index values for the samples tested ranged from 0 to 20, with an average value of 4.57. This averaged Group Index value corresponds to estimated California Bearing Ratio (CBR) value of 8.0 percent. It is recommended that the pavement design be based upon a CBR value of 8.0.

A copy of the GB1 spreadsheet is provided in *Appendix C* of this report. Recommended areas of stabilization along with the estimated average undercut depths are summarized in Table 1.

**Table 1. Recommended Areas of Stabilization**

Boring No.	Station		Estimated Average Undercut Depth for Width of Roadway (inches)	
			Using Geotextile Fabric and Item 204, Type B or Type C Granular Materials	Using <u>Geogrid</u> and Geotextile Fabric and Item 204, Type B Granular Materials
B-001-0-14	0+00	2+50	15.0	--
B-002-0-14	2+50	4+75	24.0	12.0
B-003-0-14	4+75	5+80	--	--
B-004-0-14	5+80	6+35	15.0	--
B-005-0-14	6+35	7+40	15.0	--
<b>Railroad Spur</b>				
B-006-0-14	7+60	8+65	15.0	--
B-007-0-14	8+65	22+50	19.0	--
B-008-0-14			18.0	--
B-009-0-14			18.0	--
B-010-0-14	22+50	25+75	40.0	24.0*
B-011-0-14	25+75	27+50	15.0	--

\* When undercut depth is equal to or greater than 16 inches, place geogrid in middle of granular backfill material and a layer of geotextile fabric on the bottom of the excavation (per GB1).

The undercut values are only estimates. The actual depths and limits of the undercutting will be determined by the Project Engineer in the field based upon proofrolling. The average undercut depth is measured from the proposed pavement subgrade level.

Based upon this information, as well as the requirements outlined in GB1, selective undercutting could be utilized for all of the roadway sections. Based upon the requirements outlined in GB1, portions of the existing subgrade soil should be undercut and replaced with Item 703.16.C, Type B and/or Type C Granular Material underlain by Geotextile Fabric or Geogrid. Geotextile fabrics should reference Item 712.09, Type D, Subgrade-Base Separation or Stabilization material and be placed per Item 204. Geogrid should reference ODOT Supplemental Specification SS 861 and be placed per Item 204.

According to the GB1 spreadsheet, global chemical stabilization using either cement or lime kiln dust is an option. The depth of chemical stabilization from the GB1 spreadsheet is 14 inches.

Rubblize/roll is not recommended and is considered an unsuitable option for this project.

Subsequent to removal of unsuitable soils, the underlying soils may exhibit unstable conditions. In such an event, a bridge lift should be placed as outlined in Item 203.05 of the ODOT Construction and Materials Specifications (CMS). A bridge lift may be needed in the areas of borings B-002-0-14, B-005-0-14, B-006-0-14, B-008-0-14, B-009-0-14, and B-010-0-14.

Given the topography of the immediate area, and the types of soil encountered, drainage is strongly recommended during construction and for permanent design. Installation of underdrains or a similar type drainage system is recommended to lower in-situ moisture content values and aid in subgrade stability over time.

Care should be taken during excavation and construction of proposed pavement to avoid existing utilities, particularly if the subgrades are chemically stabilized using rotary soil-chemical mixers.

## **B. Retaining Wall Considerations**

The proposed retaining walls will be gravity or geogrid reinforced Segmental Concrete Block Walls in the form of Keystone Modular Units. Four soil test borings were drilled at the location of the longest and tallest walls anticipated to be constructed. Analyses of the walls were performed at station 6+00 for the Left (west) wall, and at station 6+50 for the Right (east) wall. At each of these locations, the wall heights are expected to be the highest, but should not exceed heights of 7.5 ft. Borings analyzed for the wall encountered layers of cohesive sandy silts and non-cohesive granular sands and gravels. Bedrock was not encountered in the borings.

The walls were evaluated for bearing resistance at the wall locations indicated. These analyses take into account the maximum wall height for the subsurface conditions assumed utilizing the test borings in this area. Engineering judgment was utilized to interpret the most critical soil conditions for the critical (maximum) wall height identified in a given area. Results of the analyses indicate that walls, constructed as outlined in the plans provided by Mote, will be stable and were calculated as meeting the minimum requirements for design.

The analyses presented in this section was obtained using LRFD methods and equations and is therefore not valid should the structural design of the walls be performed using methods other than those outlined in the AASHTO LRFD Design Specifications. For more information, see the Wall Calculations in Appendix D.

Wall leveling pads will be constructed on stiff to hard cohesive soils and dense to very dense granular soils over very stiff to hard sandy silt. The calculated factored bearing resistance of the soils in the upper 5.5± feet of the soil profiles identified is 2.2 ksf. This value is based on the strength limit state of the bearing soils and assumes a resistance factor of 0.45.

Settlement analyses for the walls indicate 0.81 to 0.67 inches of settlement is predicated for the walls. A percentage of the underlying soils are granular and will consolidate immediately with the application of the load; thus, the consolidation settlement will be less than 1.0 inch. Please note that our settlement calculations are based on soil conditions encountered in the borings, which are located outside of the footprint of the proposed walls. Since the existing walls and retained soils are already located near the locations of the proposed walls, one may assume that the soils underlying the existing walls may have already been pre-consolidated in relation to the soils represented by the borings. For this reason our settlement calculations should be considered as conservative values.

Design details for the walls are unknown. Preliminary estimates for the sliding resistance and limiting eccentricity of the walls are estimated to be acceptable, based on the limited information provided about the walls. Detailed analyses of the walls were not performed, given that the actual design for the walls is unknown. CTL can evaluate the stability of the walls in greater detail, once wall design parameters are provided. The active pressure on the walls may be determined using an equivalent friction angle of 30 degrees and a total unit weight equal to 125 pounds per cubic foot (pcf) for the retained soils.

Based on the soil type and the Standard Penetration Test (SPT) and/or Average Undrained Shear Strength ( $S_u$ ), the Site Class for the project walls is Class D per AASHTO LRFD Bridge Design Specifications, 2012, Table 3.10.3.1-1. Using a Site Class D and a Peak Ground Acceleration Coefficient  $PGA = 0.055$  results in an Acceleration Coefficient ( $S_{D1}$ ) of 0.104. From Table 3.10.6-1, Seismic Zones, an Acceleration Coefficient of 0.104 indicates Seismic Zone 1.

### **C. General Construction and Earthwork**

1. Site preparation and earthwork should be performed in accordance with the ODOT Construction and Material Specifications, and applicable Geotechnical Bulletins.
2. Embankment slopes constructed at a rate of 2:1 Horizontal to Vertical or flatter are generally considered safe against sliding and slope failure. Slopes should be seeded and vegetation growth permitted to limit sloughing and slope failure.
3. Temporary excavations in excess of 4.0 feet in depth should be sloped or shored in accordance with OSHA regulations.

## **VII. CHANGED CONDITIONS**

The evaluations, conclusions, and recommendations in this report are based on our interpretation of the field and laboratory data obtained during the exploration, our understanding of the project and our experience with similar sites and subsurface conditions using generally accepted geotechnical engineering practices. Although individual test borings are representative of the subsurface conditions at the boring locations on the dates drilled, they are not necessarily representative of the subsurface conditions between boring locations or subsurface conditions during other seasons of the year.

In the event that changes in the project are proposed, additional information becomes available, or if it is apparent that subsurface conditions are different from those provided in this report, CTL Engineering should be notified so that our recommendations can be modified, if required.

## **VIII. TESTING AND OBSERVATIONS**

During the design process, it is recommended that CTL Engineering work with the project designers to confirm that the geotechnical recommendations are properly incorporated into the final plans and specifications, and to assist with establishing criteria for the construction observation and testing.

CTL Engineering is not responsible for independent conclusions, opinions and recommendations made by others based on the data and recommendations provided in this report. It is recommended that CTL be retained to provide construction quality control services on this project. If CTL Engineering is not retained for these services, CTL shall assume no responsibility for compliance with the design concepts or recommendations provided.

## **IX. CLOSURE**

The report was prepared by CTL Engineering, Inc. (Consultant) solely for the use of the Client in accordance with an executed contract. The Client's use of or reliance on this report is limited by the terms and conditions of the contract and by the qualifications and limitations stated in the report. It is also acknowledged that the Client's use of and reliance of this report is limited for reasons which include: actual site conditions that may change with time; hidden conditions, not discoverable within the scope of the assessment, may exist at the site; and the scope of the investigation may have been limited by time, budget and other constraints imposed by the Client.

Neither the report, nor its contents, conclusions or recommendations are intended for the use of any party other than the Client. Consultant and the Client assume no liability for any reliance placed on this report by such party. The rights of the Client under contract may not be assigned to any person or entity, without the consent of the Consultant which consent shall not be unreasonably withheld.

This geotechnical report does not address the environmental conditions of the site. The Consultant is not responsible for consequences or conditions arising from facts that were concealed, withheld, or not fully disclosed at the time the assessment was conducted.

To the fullest extent permitted by law, the Consultant and Client agree to indemnify and hold each other, and their officers and employees harmless from and against claims, damages, losses and expenses arising out of unknown or concealed conditions. Furthermore, neither the Consultant nor its employees shall be liable to the Owner in an amount in excess of the available professional liability insurance coverage of the Consultant. In addition, Client and Consultant agree neither shall be liable for any special, indirect or consequential damages of any kind or nature.

The Consultant's services have been provided consistent with its professional standard of care. No other warranties are made, either expressed or implied.

We thank you for the opportunity to be of service to you on this project. If you have any questions, please contact our office.

Respectfully Submitted,  
**CTL ENGINEERING, INC.**



Frederick Schoen, P.E.  
Project Manager



Joe Grani, P.E.  
Technical Reviewer

APPENDIX A

**EXPLORATION PLAN SHEETS**



**PROJECT DESCRIPTION**

THE PROJECT IS THE FULL-DEPTH RECONSTRUCTION AND SLIGHT WIDENING OF SWEITZER STREET, BETWEEN PINE STREET AND WHERE IT HAS A BEND IN THE ROAD TO FORM WEST FOURTH STREET; AND WEST FOURTH STREET, FROM SWEITZER STREET TO SYCAMORE STREET, IN GREENVILLE, OHIO. THE NEW ROADWAY PROFILE REQUIRES ONLY MINOR CUT AND MINOR FILL TO ESTABLISH THE PROPOSED GRADE. THE HORIZONTAL ALIGNMENT OF THE ROADWAY WILL REMAIN UNCHANGED. THE ROADWAY DOES CROSS AN EXISTING RAILROAD SPUR OPERATED BY R.J. CORMAN NEAR STATION 7+50.

**HISTORIC RECORDS**

A DOCUMENT SEARCH OF THE OHIO DEPARTMENT OF TRANSPORTATION (ODOT) GEOTECHNICAL DATA MANAGEMENT SYSTEM (GEOMS) FOR HISTORICAL RECORDS WAS PERFORMED. NO GEOTECHNICAL RECORDS WERE FOUND TO BE AVAILABLE FOR REVIEW.

**GEOLOGY**

SURFACE SOILS ACROSS THE PROJECT INCLUDE MIAMIAN SILT LOAM WITH 2 TO 6 PERCENT SLOPES (MMB), AND CROSBY SILT LOAM WITH 0 TO 2 PERCENT SLOPES (CRA). THE PROJECT SITE LIES WITHIN THE SILTY LOAM TILL PLAIN SECTION OF THE CENTRAL LOWLANDS PHYSIOGRAPHIC PROVINCE OF OHIO AND IS LOCATED IN A REGION WHERE SAND AND GRAVEL DEPOSITS ARE TYPICALLY INTERBEDDED IN GLACIAL TILL. THE REGIONAL AREA INCLUDES DEPOSITS OF WISCONSIN AGE (GLACIAL) TILL, OUTWASH, AND ICE-CONTACT SAND AND GRAVELS (KAMES AND ESKERS). THE UNION CITY END MORAINNE IS LOCATED A FEW MILES NORTH OF THE SITE AND THE SITE IS ALSO WITHIN THE GEOMORPHIC "BOULDER BELT OF WESTERN OHIO", WHICH CONSISTS OF A REGION OF LAND HAVING A HIGH CONCENTRATION OF SURFACE AND SUBSURFACE COBBLES AND BOULDERS.

THE GREENVILLE AREA IS UNDERLAIN BY SEDIMENTARY ROCK OF LOWER SILURIAN AND ORDOVICIAN AGE. THE PROJECT SITE RESIDES DIRECTLY OVER THE SILURIAN AGE LOCKPORT DOLOMITE AND THE TOP OF BEDROCK IS EXPECTED TO BE AT DEPTHS NEAR 140 FEET BELOW EXISTING SURFACE GRADES. NO KNOWN KARST OR UNDERGROUND MINE RELATED INCIDENTS EXIST AT THE PROJECT SITE.

**RECONNAISSANCE**

THE EXISTING ROADWAY IS A TWO-LANE, BI-DIRECTIONAL ROADWAY. THE ROAD SURFACE CONSISTS OF ASPHALT CONCRETE THAT WAS FOUND TO EXHIBIT MINOR WHEEL PATH DEPRESSIONS, ISOLATED AREAS OF LIGHT TO HEAVY CRACKING, AND A FEW POTHOLES. THE ROAD SURFACE IS RELATIVELY LEVEL OR SLIGHTLY DEPRESSED IN COMPARISON TO THE LAND SURROUNDING THE ROADWAY. STORM WATER COLLECTION FEATURES DRAIN THE EXISTING ROAD. LAND USAGE OUTSIDE OF THE ROADWAY IS PRIMARILY RESIDENTIAL HOMES, WITH A KNOWN BUSINESS, PUBLIC SERVICE BUILDING, AND CHURCH LOCATED BETWEEN CENTRAL AVENUE AND SYCAMORE STREET.

**SUBSURFACE EXPLORATION**

ELEVEN (11) SOIL TEST BORINGS WERE DRILLED FOR THE SUBSURFACE EXPLORATION. THESE BORINGS WERE DRILLED WITHIN OF THE EXISTING PAVEMENT AND WERE EXTENDED INTO THE SOIL SUBGRADE TO DEPTHS OF 10.0 TO 20.0 FEET BELOW EXISTING SURFACE GRADES. TEST BORINGS WERE ADVANCED UTILIZING A TRUCK MOUNTED DRILL RIG WITH 3.25-INCH INSIDE DIAMETER HOLLOW-STEM AUGERS. STANDARD PENETRATION TESTS WERE CONDUCTED IN THE TEST BORINGS USING AN AUTOMATIC 140-POUND HAMMER FALLING 30 INCHES TO DRIVE A 2-INCH OUTSIDE DIAMETER SPLIT-SPOON SAMPLER FOR 18 INCHES. THE DRILL RIG'S HAMMER WAS PREVIOUSLY CALIBRATED ON SEPTEMBER 24, 2013, AND HAS A DRILL ROD ENERGY RATIO OF 84.4 PERCENT.

TWO (2) HAND AUGERED BORINGS WERE ALSO PERFORMED IN THE FRONT YARDS OF TWO (2) RESIDENTIAL HOMES. HAND AUGERED BORINGS WERE EXTENDED TO DEPTHS OF 6.5 FEET TO 7.5 FEET USING HAND OPERATED BUCKET AUGERS AND MANUAL DRIVE HAMMERS.

**EXPLORATION FINDINGS**

TEST BORINGS ENCOUNTERED 3 TO 6 INCHES OF ASPHALT PAVEMENT MATERIALS BEFORE THREE BORINGS AT THE SOUTHERN PORTION OF THE SITE ENCOUNTERED A LAYER OF BRICK; ELSE, BORINGS ENCOUNTERED 5 TO 8 INCHES OF CRUSHED AGGREGATE SUBBASE MATERIALS.

BELOW THE SURFACE MATERIALS, THE BORINGS EXHIBITED A VARIETY OF SOIL TYPES THAT WERE IDENTIFIED AS BEING PREDOMINATELY DAMP TO MOIST AND INCLUDED GRAVEL AND/OR STONE FRAGMENTS (A-1-a), GRAVEL AND/OR STONE FRAGMENTS WITH SAND (A-1-b), GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT (A-2-4), GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT AND CLAY (A-2-6), FINE TO COARSE SAND (A-3a), SANDY SILT (A-4a), SILT AND CLAY (A-6a), SILTY CLAY (A-6b) AND CLAY (A-7-6) SOILS. SOILS FOUND IN THE UPPER SEVERAL FEET OF BORINGS WERE SOMETIMES IDENTIFIED AS BEING PREVIOUSLY PLACED FILL MATERIALS THAT INCLUDED ASPHALT FRAGMENTS, SLAG, AND COBBLES. NO BEDROCK WAS ENCOUNTERED IN THE BORINGS.

**LEGEND**

DESCRIPTION	ODOT CLASS	CLASSIFIED MECH./VISUAL
GRAVEL AND/OR STONE FRAGMENTS	A-1-a	1 1
GRAVEL AND/OR STONE FRAGMENTS WITH SAND	A-1-b	1 3
GRAVEL AND/OR STONE FRAGMENTS W/SAND AND SILT	A-2-4	0 1
GRAVEL AND/OR STONE FRAGMENTS W/SAND, SILT & CLAY	A-2-6	5 7
COARSE AND FINE SAND	A-3a	0 1
SANDY SILT	A-4a	12 26
SILT AND CLAY	A-6a	2 5
SILTY CLAY	A-6b	1 1
CLAY	A-7-6	4 1
<b>TOTAL</b>		<b>26 46</b>
PAVEMENT OR BASE = X = APPROXIMATE THICKNESS	VISUAL	
SOD AND TOPSOIL = 6" = APPROXIMATE THICKNESS	VISUAL	
EXPLORATION LOCATION - PLAN VIEW		
DRIVE SAMPLE AND/OR ROCK CORE BORING PLOTTED TO VERTICAL SCALE ONLY. HORIZONTAL BAR INDICATES A CHANGE IN STRATIGRAPHY.		
WC	INDICATES WATER CONTENT IN PERCENT.	
W	INDICATES FREE WATER ELEVATION.	
*	INDICATES A SAMPLE TAKEN WITHIN 3 FT OF PROPOSED GRADE.	
N <sub>60</sub>	INDICATES STANDARD PENETRATION RESISTANCE NORMALIZED TO 60% DRILL ROD ENERGY RATIO.	
HA	INDICATES AN AUGER SAMPLE.	
AS	INDICATES A HAND AUGER SAMPLE.	
SS	INDICATES A SPLIT-SPOON SAMPLE.	
NP	INDICATES A NON-PLASTIC SAMPLE.	

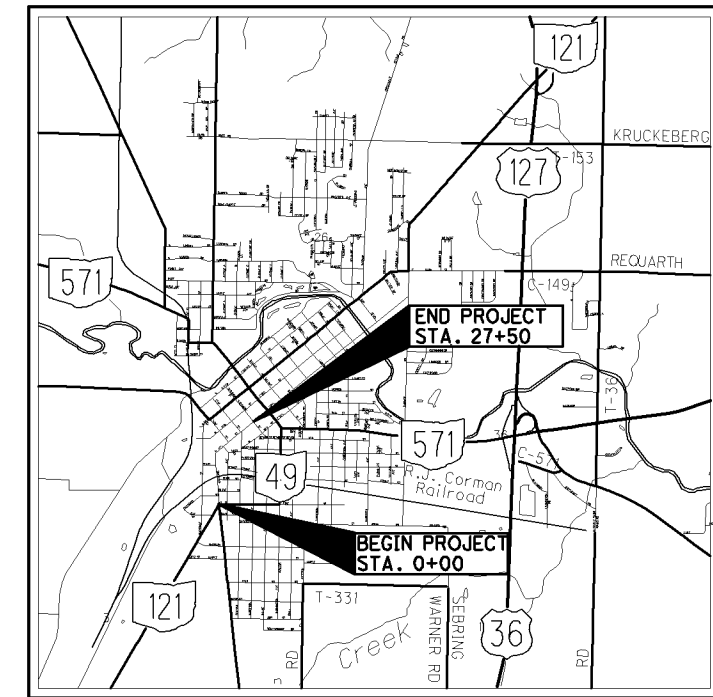
GROUNDWATER WAS ONLY RECORDED IN BORING B-005-0-14 AT A DEPTH OF 17.0 FEET BELOW EXISTING SURFACE GRADE, WHICH CORRESPONDS TO ELEVATION 1022.6 FEET.

**SPECIFICATIONS**

THIS GEOTECHNICAL EXPLORATION WAS PERFORMED IN ACCORDANCE WITH THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, OFFICE OF GEOTECHNICAL ENGINEERING, SPECIFICATIONS FOR GEOTECHNICAL EXPLORATIONS, DATED JULY, 2014

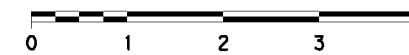
**AVAILABLE INFORMATION**

ALL AVAILABLE SOIL AND BEDROCK INFORMATION THAT CAN BE CONVENIENTLY SHOWN ON THE GEOTECHNICAL EXPLORATIONS SHEETS HAS BEEN SO REPORTED. ADDITIONAL EXPLORATIONS MAY HAVE BEEN MADE TO STUDY SOME ASPECT OF THE PROJECT. COPIES OF THIS DATA, IF ANY, MAY BE INSPECTED IN THE DISTRICT DEPUTY DIRECTOR'S OFFICE OR THE OFFICE OF GEOTECHNICAL ENGINEERING AT 1980 WEST BROAD STREET.

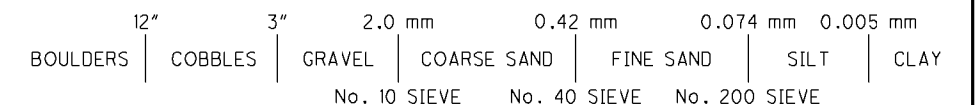


LOCATION MAP

SCALE IN MILES



**PARTICLE SIZE DEFINITIONS**



RECON. - FLS 7/25/14 - 8/20/14

DRILLING - CTL 8/4/14 - 8/5/14

DRAWN - BRU 08/27/14 & 11/19/14

REVIEWED - FLS 8/28/14 & 11/19/14

INDEX OF SHEETS						
LOCATION FROM STA. TO STA.	PLAN VIEW SHEET	PROFILE SHEET	CROSS-SECTION SHEET	CUT MAX.	FILL EMB. MAX.	
SWEITZER ST. 0+00 10+00	3	3	6	<0.5 FT	<0.5 FT	
W. FOURTH ST. 10+00 20+00	4	4	-	<0.5 FT	<0.5 FT	
20+00 29+10	5	5	-	<0.5 FT	<0.5 FT	





SUMMARY OF SOIL TEST DATA  
SWEITZER STREET

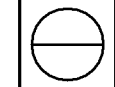
EXPLORATION NO., STATION & OFFSET	FROM	TO	SAMPLE ID	% REC	HP (t <sub>s</sub> f)	% GR	% CS	% FS	% SILT	% CLAY	LL	PL	PI	% WC	ODOT CLASS (GI)	SO <sub>4</sub> (ppm)
B-001-0-14 STA. 1+07, 13.5' RT. LATITUDE = 40.093903 LONGITUDE = -84.636004	01.00	-02.50	SS-1	61	1.50	11	6	8	25	50	58	21	37	28	A-7-6 (2)*	
	02.50	-04.00	SS-2	17	-	GRAVEL AND/OR STONE FRAG. WITH SAND, DAMP						6	A-1-b (VISUAL)*			
	04.00	-05.50	SS-3	78	0.50	48	18	10	14	10	25	15	10	12	A-2-4 (0)	
	05.00	-07.00	SS-4	89	2.50	SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, WITH COBBLES, DAMP						8	A-4a (VISUAL)			
	08.50	-10.00	SS-5	83	-	GRAVEL AND/OR STONE FRAG. WITH SAND AND SILT, TRACES OF CLAY, MOIST						16	A-2-4 (VISUAL)			
B-006-0-14 STA. 10+62, 11.0' RT. LATITUDE = 40.096511 LONGITUDE = -84.636375	01.00	-02.50	SS-1	56	1.50	8	13	15	39	25	24	14	10	19	A-4a (6)*	< 100
	02.50	-04.00	SS-2	50	1.50	1	7	17	40	35	25	17	8	19	A-4a (8)*	
	04.00	-05.50	SS-3	61	2.50	SILT AND CLAY, LITTLE SAND, MOIST						21	A-6a (VISUAL)			
	05.00	-07.00	SS-4	28	0.50	SANDY SILT, SOME CLAY, LITTLE GRAVEL, DAMP						12	A-4a (VISUAL)			
	08.50	-10.00	SS-5	28	-	SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP						12	A-4a (VISUAL)			

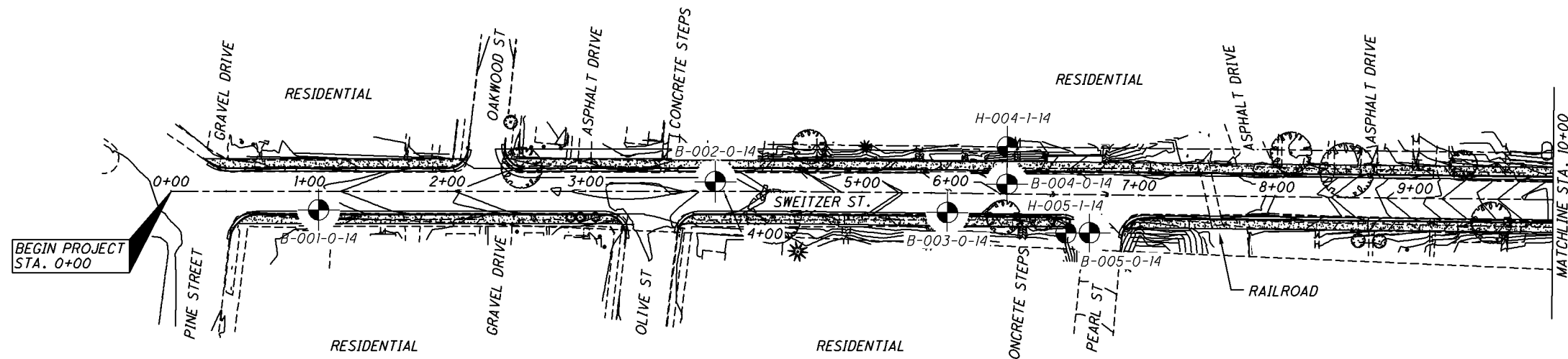
SUMMARY OF SOIL TEST DATA  
WEST FOURTH STREET

B-007-0-14 STA. 14+34, 14.0' RT. LATITUDE = 40.097465 LONGITUDE = -84.636370	01.00	-02.50	SS-1	83	2.00	0	29	33	9	29	32	17	15	17	A-6a (2)*	< 100
	02.50	-04.00	SS-2	61	4.50	22	17	16	22	23	20	15	5	7	A-4a (2)*	
	04.00	-05.50	SS-3	78	1.00	GRAVEL AND/OR STONE FRAG. WITH SAND, SILT, AND CLAY, MOIST						17	A-2-6 (VISUAL)			
	05.00	-07.00	SS-4	56	4.50	SANDY SILT, SOME CLAY, LITTLE GRAVEL, WITH COBBLES, DAMP						8	A-4a (VISUAL)			
	08.50	-10.00	SS-5	100	4.50	SAME AS SS-4						9	A-4a (VISUAL)			
B-008-0-14 STA. 17+76, 14.5' RT. LATITUDE = 40.098147 LONGITUDE = -84.635517	01.00	-02.50	SS-1	72	2.00	6	10	15	21	48	53	18	35	25	A-7-6 (17)*	< 100
	02.50	-04.00	SS-2	56	-	21	12	14	21	32	40	17	23	24	A-6b (9)*	
	04.00	-05.50	SS-3	11	1.00	SILT AND CLAY, SOME SAND, LITTLE GRAVEL, DAMP						14	A-6a (VISUAL)			
	05.00	-07.00	AS-4	-	-	SAME AS SS-3						14	A-6a (VISUAL)			
	08.50	-10.00	SS-5	100	4.50	SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, DAMP						8	A-4a (VISUAL)			
B-009-0-14 STA. 20+85, 11.0' RT. LATITUDE = 40.098639 LONGITUDE = -84.634642	01.00	-02.50	SS-1	39	2.00	11	12	17	18	42	54	18	36	25	A-7-6 (15)*	
	02.50	-04.00	SS-2	100	2.50	39	15	13	17	16	22	15	7	10	A-2-4 (0)*	200
	04.00	-05.50	SS-3	22	-	SILTY CLAY, LITTLE SAND, MOIST						25	A-6b (VISUAL)			
	05.00	-07.00	SS-4	50	1.00	SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, WITH COBBLES, DAMP						12	A-4a (VISUAL)			
	08.50	-10.00	SS-5	100	4.00	SAME AS SS-4						9	A-4a (VISUAL)			
B-010-0-14 STA. 24+34, 11.0' LT. LATITUDE = 40.099273 LONGITUDE = -84.633676	01.00	-02.50	SS-1	28	-	58	15	12	11	4	NP	NP	NP	5	A-1-a (0)*	
	02.50	-04.00	SS-2	44	-	SAME AS SS-1						12	A-1-a (VISUAL)*			
	04.00	-05.50	SS-3	56	1.00	33	17	12	21	17	22	15	7	13	A-4a (1)	
	05.00	-07.00	SS-4	67	1.50	SAME AS SS-3						13	A-4a (VISUAL)			
	07.00	-08.50	SS-5	28	-	GRAVEL AND/OR STONE FRAG. WITH SAND AND SILT, DAMP						9	A-2-4 (VISUAL)			
	08.50	-10.00	AS-6	-	-	SANDY SILT, LITTLE CLAY, LITTLE GRAVEL, DAMP						-	A-4a (VISUAL)			
B-011-0-14 STA. 26+76, 15.0' RT. LATITUDE = 40.099784 LONGITUDE = -84.633036	01.00	-02.50	SS-1	100	1.50	5	8	12	32	43	48	19	29	9	A-7-6 (17)*	
	02.50	-04.00	SS-2	89	1.00	SAME AS SS-1						19	A-7-6 (VISUAL)*	540		
	04.00	-05.50	SS-3	100	3.00	29	18	10	21	22	24	16	8	12	A-4a (2)	
	05.00	-07.00	SS-4	56	3.50	SAME AS SS-3						13	A-4a (VISUAL)			
	08.50	-10.00	SS-5	83	-	SAME AS SS-3						17	A-4a (VISUAL)			

SOIL PROFILE  
SUMMARY OF SOIL TEST DATA

DAR SWEITZER ST.

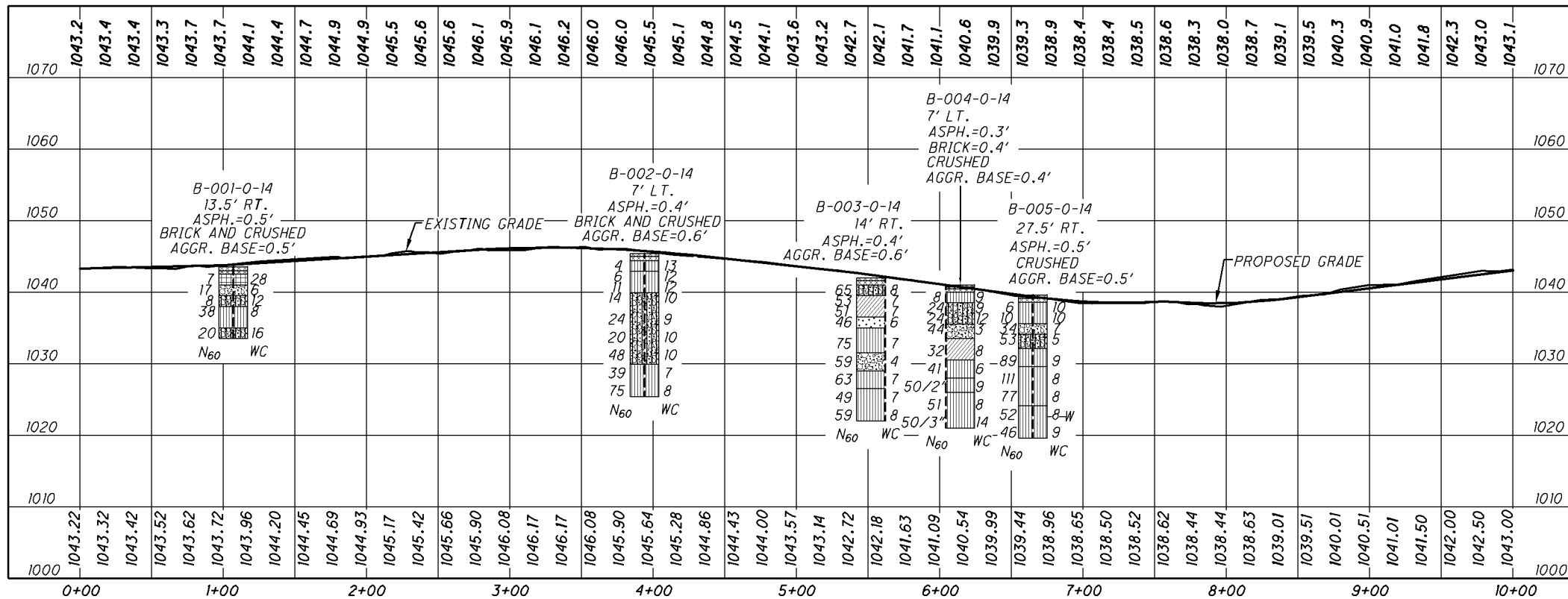




**NOTE:**

FOR SOIL PROFILE CROSS SECTIONS FOR STATIONS 6+00 AND 6+50 SEE SHEET NO. 6

SEE SHEET 6 OF 9 FOR HAND AUGERS H-004-1-14 AND H-005-1-14 PROFILES



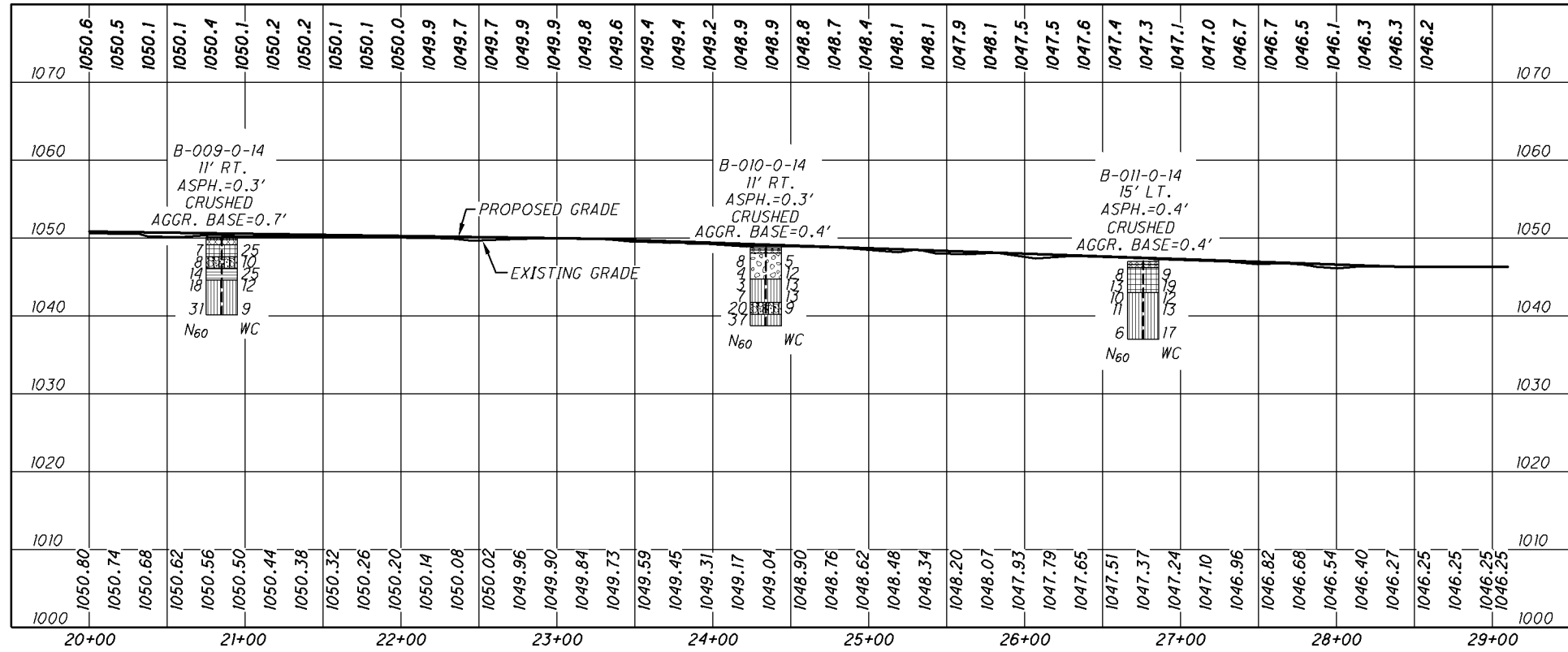
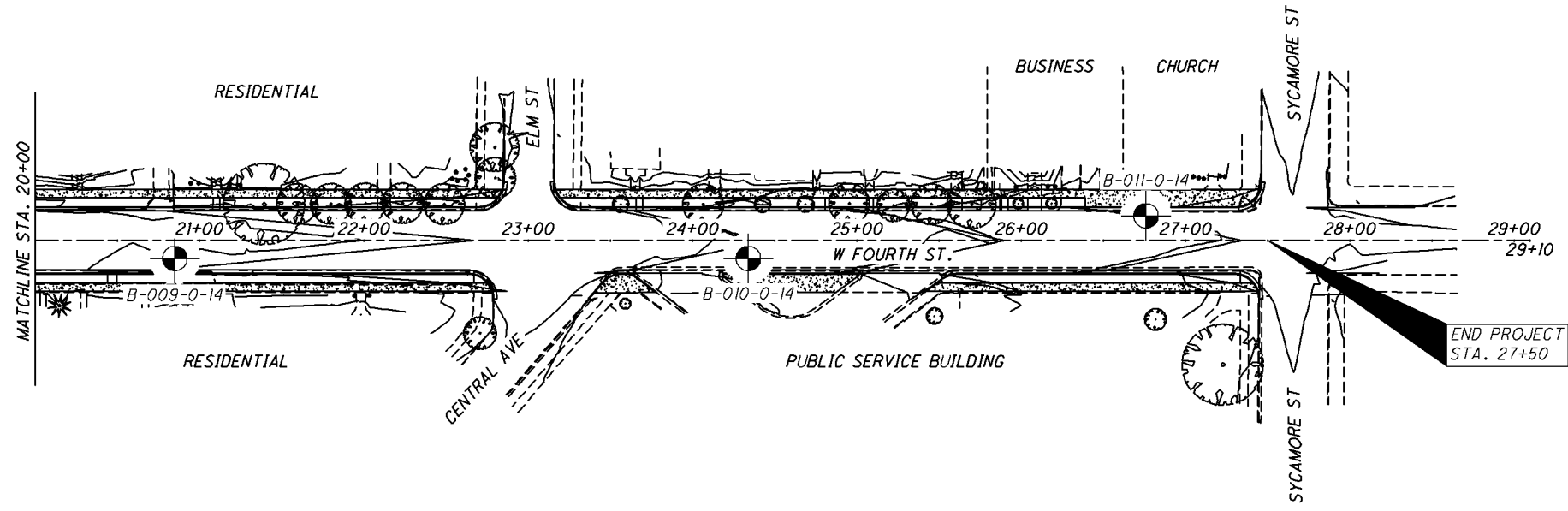
DRAWN BY: BRU  
CHECKED BY: FS

**SOIL PROFILE  
STA. 0+00 TO STA. 10+00**

**DAR SWEITZER ST.**







DRAWN BY: BRU  
CHECKED BY: FS

**SOIL PROFILE**  
**STA. 20+00 TO 29+10**

**DAR SWEITZER ST.**



**NOTE:**

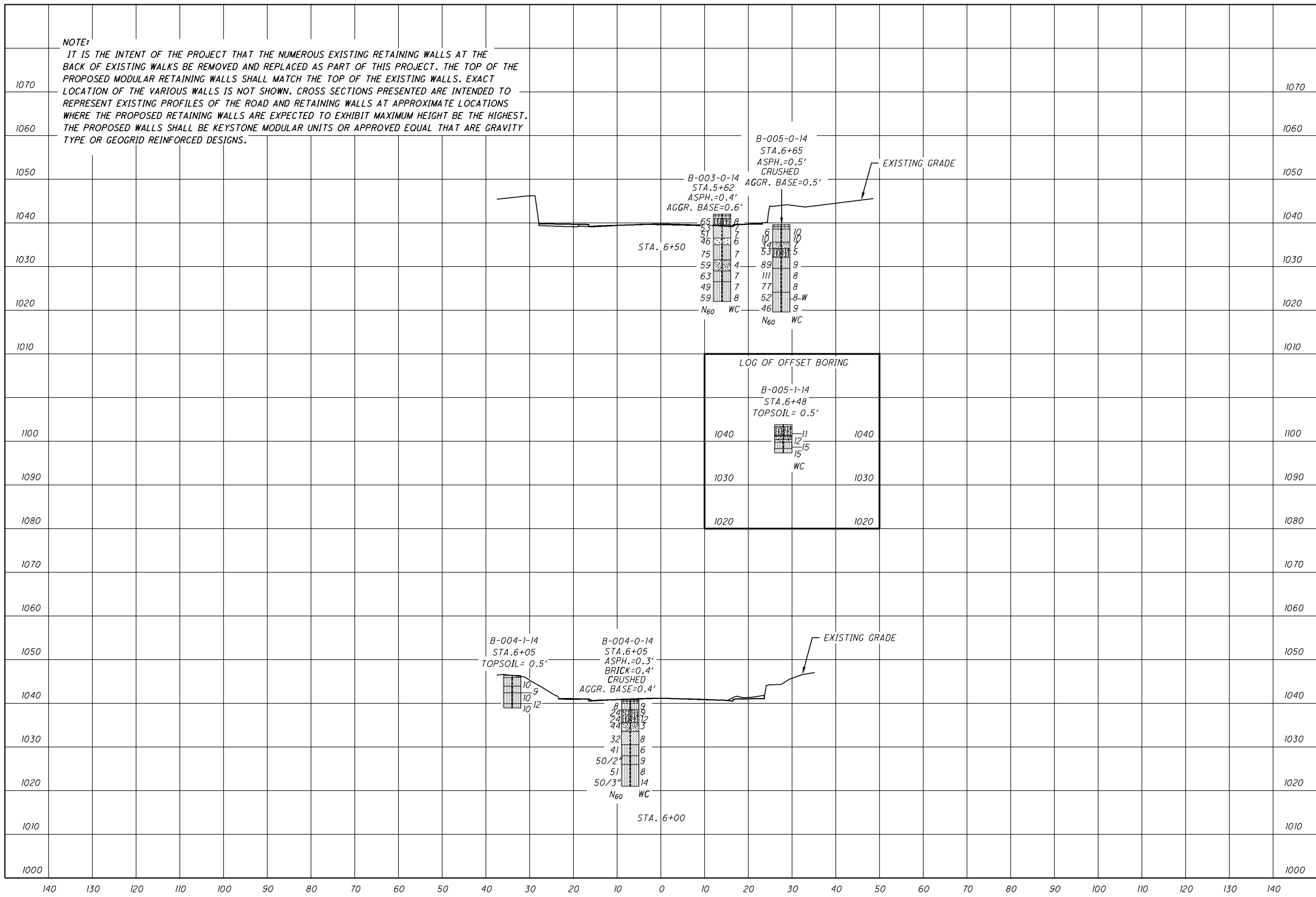
IT IS THE INTENT OF THE PROJECT THAT THE NUMEROUS EXISTING RETAINING WALLS AT THE BACK OF EXISTING WALKS BE REMOVED AND REPLACED AS PART OF THIS PROJECT. THE TOP OF THE PROPOSED MODULAR RETAINING WALLS SHALL MATCH THE TOP OF THE EXISTING WALLS. EXACT LOCATION OF THE VARIOUS WALLS IS NOT SHOWN. CROSS SECTIONS PRESENTED ARE INTENDED TO REPRESENT EXISTING PROFILES OF THE ROAD AND RETAINING WALLS AT APPROXIMATE LOCATIONS WHERE THE PROPOSED RETAINING WALLS ARE EXPECTED TO EXHIBIT MAXIMUM HEIGHT BE THE HIGHEST. THE PROPOSED WALLS SHALL BE KEYSTONE MODULAR UNITS OR APPROVED EQUAL THAT ARE GRAVITY TYPE OR GEOGRID REINFORCED DESIGNS.



DRAWN: BRU  
CHECKED: FS

**SOIL PROFILE**  
**SWEITZER ST. CROSS SECTION STA. 6+00 AND STA. 6+50**

**DAR SWEITZER ST.**





PROJECT: W. FOURTH / SWEITZER ST. TYPE: ROADWAY PID: 97246 BR ID: N/A START: 8/5/14 END: 8/5/14		DRILLING FIRM / OPERATOR: CTL ENG. / Z. BEAHR SAMPLING FIRM / LOGGER: CTL ENG. / R. FOSTER DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT		DRILL RIG: CME 75 TRUCK #25 HAMMER: CME AUTOMATIC CALIBRATION DATE: 9/24/13 ENERGY RATIO (%): 84.4		STATION / OFFSET: 6+05.7.0 LT ALIGNMENT: SWEITZER ST. ELEVATION: 1041.0 (MSL) EOB: 20.0 ft. COORD: 40.095252, -84.636274		EXPLORATION ID B-004-0-14 PAGE 1 OF 1									
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ ROD	REC N <sub>60</sub>	SAMPLE ID	HP (tsf)	GRADATION (%)			GCOT CLASS (GI)	HOLE SEALED					
								GR	CS	FS	SI	CL	LL	PL	PI	WC	
ASPHALT (3")		1041.0	1														
BRICK (4")		1040.7	2	3	8	SS-1	3.00	35	15	13	20	17	21	14	7	9	A-4a (0)
CRUSHED AGGREGATE BASE (5")		1040.4	3	3													
VERY STIFF, BROWN, SANDY SILT, AND GRAVEL, LITTLE CLAY, WITH COBBLES, (FILL) DAMP		1038.5	4	3	24	SS-2	4.50	28	19	20	19	14	18	14	4	9	A-2-4 (0)
MEDIUM DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, DAMP		1035.5	5	6	24	SS-3	2.50	-	-	-	-	-	-	-	-	12	A-2-4 (V)
DENSE BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, WITH COBBLES, DAMP		1033.5	6	11	44	SS-4	-	-	-	-	-	-	-	-	-	3	A-1-b (V)
HARD, OLIVE BROWN, SILT AND CLAY, SOME SAND, TRACES OF GRAVEL, DAMP		1030.5	7	20													
HARD, GRAY, SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, DAMP		1028.0	8														
HARD, BROWN, SANDY SILT, WITH COBBLES, DAMP		1026.0	9	11	32	SS-5	4.00	-	-	-	-	-	-	-	-	8	A-6a (V)
HARD, GRAY, SANDY SILT, SOME CLAY, TRACES OF GRAVEL, WITH WET SAND SEAM, DAMP TO MOIST		1021.0	10	12													
			11	7	41	SS-6	4.50	-	-	-	-	-	-	-	-	6	A-4a (V)
			12	18													
			13	10/2"	-	100	SS-7	-	-	-	-	-	-	-	-	9	A-4a (V)
			14	25	51	SS-8	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)
			15	17	19												
			16	10/2"	-	100	SS-9	-	-	-	-	-	-	-	-	14	A-4a (V)
			17	19													
			18	10/2"	-	100	SS-9	-	-	-	-	-	-	-	-	14	A-4a (V)
			19														
			20														

NOTES: BORE HOLE CAVE-IN AT 10.0 FT.; SAMPLE SS-3 - <100 PPM SO4  
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

PROJECT: W. FOURTH / SWEITZER ST. TYPE: ROADWAY PID: 97246 BR ID: N/A START: 8/5/14 END: 8/5/14		DRILLING FIRM / OPERATOR: CTL ENG. / Z. BEAHR SAMPLING FIRM / LOGGER: CTL ENG. / R. FOSTER DRILLING METHOD: 3.25" HSA SAMPLING METHOD: SPT		DRILL RIG: CME 75 TRUCK #25 HAMMER: CME AUTOMATIC CALIBRATION DATE: 9/24/13 ENERGY RATIO (%): 84.4		STATION / OFFSET: 6+65.27.5 RT ALIGNMENT: SWEITZER ST. ELEVATION: 1039.6 (MSL) EOB: 20.0 ft. COORD: 40.095428, -84.636176		EXPLORATION ID B-005-0-14 PAGE 1 OF 1									
MATERIAL DESCRIPTION AND NOTES		ELEV.	DEPTHS	SPT/ ROD	REC N <sub>60</sub>	SAMPLE ID	HP (tsf)	GRADATION (%)			GCOT CLASS (GI)	HOLE SEALED					
								GR	CS	FS	SI	CL	LL	PL	PI	WC	
ASPHALT (6")		1039.6	1														
CRUSHED AGGREGATE BASE (6")		1039.1	2	2	6	SS-1	3.50	29	19	15	22	15	18	13	5	10	A-4a (0)
VERY STIFF, RUSTY BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP		1038.6	3	4	10	SS-2	3.00	-	-	-	-	-	-	-	-	10	A-4a (V)
DENSE BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACES OF CLAY, DAMP		1035.6	4	3													
VERY DENSE BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, DAMP		1034.1	5	9	34	SS-3	-	37	25	13	17	8	NP	NP	7	A-1-b (0)	
HARD, BROWN, SANDY SILT, SOME CLAY, LITTLE GRAVEL, DAMP		1032.1	6	16	53	SS-4	-	-	-	-	-	-	-	-	-	5	A-2-4 (V)
			7	22													
			8	25	31	89	SS-5	-	-	-	-	-	-	-	-	9	A-4a (V)
			9	31	89	17	SS-5	-	-	-	-	-	-	-	-	9	A-4a (V)
			10	32													
			11	33	111	100	SS-6	4.50	25	19	13	25	18	13	5	8	A-4a (2)
			12	39	40												
			13	40													
			14	29	77	83	SS-7	-	-	-	-	-	-	-	-	8	A-4a (V)
			15	26													
			16	11	52	94	SS-8	4.50	28	18	13	27	14	21	15	6	A-4a (1)
			17	16	21												
			18														
			19	8	14	46	SS-9	4.50	-	-	-	-	-	-	-	9	A-4a (V)
			20	19													

NOTES: BORE HOLE CAVE-IN AT 10.9 FT.; SAMPLE SS-2 - <100 PPM SO4  
ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

PROJECT: W. FOURTH / SWEITZER ST. TYPE: ROADWAY PID: 97246 BR ID: N/A START: 10/27/14 END: 10/27/14	DRILLING FIRM / OPERATOR: CTL ENG / SB SAMPLING FIRM / LOGGER: CTL ENG. / R. FOSTER DRILLING METHOD: HAND AUGER SAMPLING METHOD: BULK	DRILL RIG: HAND AUGER HAMMER: MOBILE AUTOMATIC CALIBRATION DATE: N/A ENERGY RATIO (%): 60	STATION / OFFSET: 6+05.34.0 LT ALIGNMENT: SWEITZER ST. ELEVATION: 1046.4 (MSL) EOB: 7.5 ft. COORD: 40.095181, -84.636267	EXPLORATION ID H-004-1-14 PAGE 1 OF 1
<b>MATERIAL DESCRIPTION AND NOTES</b>				
TOPSOIL	ELEV. 1046.4	SPT/ROD	GRADATION (%)	BACK FILL
VERY STIFF, BROWN, SANDY SILT, SOME CLAY, TRACES OF GRAVEL, WITH BRICK FRAGMENTS MIXED WITH TOPSOIL (FILL), DAMP	1045.9	1		
HARD, BROWN, SANDY SILT, SOME CLAY, TRACES OF GRAVEL, SLIGHTLY ORGANIC (FILL), DAMP	1043.9	2		10 A-4a (V)
VERY STIFF, BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, (POSSIBLE FILL), DAMP	1042.4	3		9 A-4a (V)
		4		
		5		10 A-4a (1)
		6		12 A-4a (V)
VERY STIFF, BROWN, SANDY SILT, SOME CLAY, DAMP	1039.9	7		10 A-4a (V)
	1038.9			
EOB				

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - 2014 ODOT.GDT - 11/19/14 15:45 - L:\WAPAK\WAPAK GEOTECH PROJECTS\1405004\3WAP1405004\3WAP.GPJ

NOTES: NO GROUNDWATER ENCOUNTERED

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS

PROJECT: W. FOURTH / SWEITZER ST. TYPE: ROADWAY PID: 97246 BR ID: N/A START: 10/27/14 END: 10/27/14	DRILLING FIRM / OPERATOR: CTL ENG / SB SAMPLING FIRM / LOGGER: CTL ENG. / R. FOSTER DRILLING METHOD: HAND AUGER SAMPLING METHOD: BULK	DRILL RIG: HAND AUGER HAMMER: MOBILE AUTOMATIC CALIBRATION DATE: N/A ENERGY RATIO (%): 60	STATION / OFFSET: 6+48.28.0 RT ALIGNMENT: SWEITZER ST. ELEVATION: 1043.8 (MSL) EOB: 6.5 ft. COORD: 40.095411, -84.636151	EXPLORATION ID H-005-1-14 PAGE 1 OF 1
<b>MATERIAL DESCRIPTION AND NOTES</b>				
TOPSOIL	ELEV. 1043.8	SPT/ROD	GRADATION (%)	BACK FILL
MEDIUM DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, MIXED WITH TOPSOIL, SLIGHTLY ORGANIC (FILL), DAMP	1043.3	1		
MEDIUM DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY, WITH ASPHALT AND BRICK FRAGMENTS (FILL), DAMP	1041.3	2		11 A-2.4 (V)
STIFF, BROWN, SANDY SILT, SOME CLAY, LITTLE GRAVEL (FILL), DAMP	1039.8	3		12 A-2.6 (V)
		4		
		5		15 A-4a (5)
MEDIUM STIFF, BROWN, SILT AND CLAY, SOME SAND, MOIST	1038.3	6		15 A-6a (V)
	1037.3			
EOB				

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - 2014 ODOT.GDT - 11/19/14 15:45 - L:\WAPAK\WAPAK GEOTECH PROJECTS\1405004\3WAP1405004\3WAP.GPJ

NOTES: NO GROUNDWATER ENCOUNTERED

ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS



DAR SWEITZER ST.

5/5

STRUCTURE FOUNDATION EXPLORATION  
BORING LOGS H-004-1-14 AND H-005-1-14

DRAWN  
BRU  
CHECKED  
FS



APPENDIX B

**TEST BORING RECORDS**

## SOIL DESCRIPTION

Descriptors for soil consistency used in this report are based upon the Standard Penetration Test (SPT), ASTM D 1587, with the penetration (N) values corrected to  $N_{60}$ , based upon the efficiency of the SPT Hammer used for the soil sampling.

Descriptors for both non-cohesive and cohesive soils are presented below, with the corresponding range of corrected penetration values.

<u>NON-COHESIVE SOIL DESCRIPTION</u>	<u>CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)</u>
Very Loose.....	0 – 4
Loose.....	5 – 10
Medium Dense.....	11- 30
Dense.....	31 – 50
Very Dense.....	Over 50

<u>COHESIVE SOIL DESCRIPTION</u>	<u>CORRECTED PENETRATION VALUES BLOWS PER FOOT (BPF)</u>
Very Soft.....	0 – 1
Soft.....	2 – 4
Medium Stiff.....	5 – 8
Stiff.....	9 – 15
Very Stiff.....	16 – 30
Hard.....	Over 30

Moisture term descriptors for both non-cohesive and cohesive soils are presented below.

<u>NON-COHESIVE SOIL DESCRIPTION</u>	<u>MOISTURE TERMS</u>	<u>COHESIVE SOIL DESCRIPTION</u>
Powdery.....	Dry.....	Powdery
Some Moisture.....	Damp.....	Below Plastic Limit
Damp to the Touch.....	Moist.....	Above Plastic, Below Liquid Limit
Free Water.....	Wet.....	Above Liquid Limit

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOT\FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>1+07, 13.5 RT</u>	EXPLORATION ID <u>B-001-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1043.5 (MSL)</u> EOB: <u>10.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.093902660, -84.636003752</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (6")	1043.5																	
BRICK and CRUSHED AGGREGATE BASE (6")	1043.0	1	2															
STIFF, GREEN, BLUE, AND GRAY, CLAY, SOME SILT, LITTLE SAND, LITTLE GRAVEL, (FILL), MOIST	1042.5	2	4	7	61	SS-1	1.50	11	6	8	25	50	58	21	37	28	A-7-6 (20)	
MEDIUM DENSE, DARK RED, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, WITH SLAG FRAGMENTS (FILL), DAMP	1041.0	3	3	5	17	SS-2	-	-	-	-	-	-	-	-	-	6	A-1-b (V)	
LOOSE, BROWN WITH GRAY, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, TRACES OF CLAY, (FILL), DAMP	1039.5	4	2	3	8	SS-3	0.50	48	18	10	14	10	25	15	10	12	A-2-4 (0)	
VERY STIFF, BROWN, SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, WITH COBBLES, DAMP	1038.0	5	11	12	38	SS-4	2.50	-	-	-	-	-	-	-	-	8	A-4a (V)	
	1035.0	6	12	15														
MEDIUM DENSE, BROWN WITH WHITE, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, TRACES OF CLAY, MOIST	1033.5	7	5	7	20	SS-5	-	-	-	-	-	-	-	-	-	16	A-2-4 (V)	
		8																
		9																
		10																
		EOB																

NOTES: BORE HOLE CAVE-IN AT 5.5 FT.

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEO\TECHNICAL\14050043\WAP.MOT\F04RTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>3+94, 7.0 LT</u>	EXPLORATION ID <u>B-002-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1045.4 (MSL)</u> EOB: <u>20.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.094682430, -84.636201996</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED	
								GR	CS	FS	SI	CL	LL	PL	PI				
ASPHALT (5")	1045.4																		
BRICK and CRUSHED AGGREGATE BASE (7")	1044.9	1																	
STIFF, BROWN, SANDY SILT, SOME CLAY, SOME GRAVEL, (FILL), DAMP	1044.4	2	1	4	83	SS-1	2.00	24	17	15	22	22	23	15	8	13	A-4a (2)		
VERY STIFF, BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP	1042.9	3	2	6	72	SS-2	4.50	-	-	-	-	-	-	-	-	12	A-4a (V)		
		4	2																
		5	3	4	11	89	SS-3	3.50	32	15	13	22	18	21	14	7	12	A-4a (1)	
MEDIUM DENSE TO DENSE, OLIVE BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, DAMP	1039.9	6	3	4	14	72	SS-4	2.50	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
		7	4																
		8																	
		9	7	8	24	78	SS-5	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
		10	8																
		11	6	6	20	67	SS-6	2.50	-	-	-	-	-	-	-	-	10	A-2-4 (V)	
		12	6																
		13																	
		14	6	13	48	72	SS-7	-	37	14	14	20	15	20	13	7	10	A-2-4 (0)	
		15		21															
VERY STIFF TO HARD, GRAY, SANDY SILT, SOME GRAVEL, LITTLE CLAY, WITH COBBLES, DAMP	1029.9	16	8																
		17	12	39	100	SS-8	3.00	26	20	16	22	16	20	14	6	7	A-4a (1)		
		18	16																
		19	15	75	100	SS-9	-	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
	1025.4	20	31	22															
		EOB																	

NOTES: BORE HOLE CAVE-IN AT 10.5 FT.: SAMPLE SS-2 - <100 PPM SO4  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOTE\FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>5+62, 14.0 RT</u>	EXPLORATION ID <u>B-003-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1042.0 (MSL)</u> EOB: <u>20.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.095138329, -84.636188977</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (5")	1042.0																	
CRUSHED AGGREGATE BASE (7")	1041.6																	
VERY DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, (FILL), DAMP	1041.0	1	15															
	1039.5	2	21	65	89	SS-1	-	45	21	5	15	14	20	13	7	8	A-2-4 (0)	
		3	15															
HARD, BROWN, SILT AND CLAY, SOME SAND, SOME GRAVEL, DAMP		4	18	53	100	SS-2	4.50	29	17	17	20	17	32	18	14	7	A-6a (1)	
		5	12															
HARD, BROWN, SILT AND CLAY, SOME SAND, SOME GRAVEL, DAMP	1036.5	6	15	51	83	SS-3	4.50	-	-	-	-	-	-	-	-	7	A-6a (V)	
		7	7															
DENSE, BROWN, COARSE AND FINE SAND, DAMP	1035.0	8	11	46	56	SS-4	4.50	-	-	-	-	-	-	-	-	6	A-3a (V)	
		9																
HARD, BROWN, SANDY SILT, LITTLE CLAY, LITTLE GRAVEL, DAMP	1031.5	10	8															
		11	21	75	61	SS-5	4.50	-	-	-	-	-	-	-	-	7	A-4a (V)	
		12	32															
VERY DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, TRACES OF SILT, TRACES OF CLAY, DAMP	1029.0	13	17	59	50	SS-6	-	-	-	-	-	-	-	-	-	4	A-1-b (V)	
		14	15															
HARD, BROWN, SANDY SILT, SOME CLAY, TRACES OF GRAVEL, WITH COBBLES, DAMP	1026.5	15	16	63	56	SS-7	4.50	-	-	-	-	-	-	-	-	7	A-4a (V)	
		16	21															
HARD, GRAY, SANDY SILT, SOME CLAY, LITTLE GRAVEL, DAMP	1022.0	17	17	49	61	SS-8	4.50	-	-	-	-	-	-	-	-	7	A-4a (V)	
		18	15															
		19	20															
		20	10	59	61	SS-9	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)	
		EOB	19															
			23															

NOTES: BORE HOLE CAVE-IN AT 9.0 FT.: SAMPLE SS-3 - <100 PPM SO4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEO\TECHNICAL\14050043\WAP.MOT\F04RTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>6+05, 7.0 LT</u>	EXPLORATION ID <u>B-004-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1041.0 (MSL)</u> EOB: <u>20.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.095251965, -84.636274280</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (3")	1041.0																	
BRICK (4")	1040.7	1	3															
CRUSHED AGGREGATE BASE (5")	1040.4	2	3	8	61	SS-1	3.00	35	15	13	20	17	21	14	7	9	A-4a (O)	
VERY STIFF, BROWN, SANDY SILT, AND GRAVEL, LITTLE CLAY, WITH COBBLES, (FILL), DAMP	1040.0	3	3															
MEDIUM DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, DAMP	1038.5	3	3	24	50	SS-2	4.50	28	19	20	19	14	18	14	4	9	A-2-4 (O)	
DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, WITH COBBLES, DAMP	1035.5	4	6	24	11	SS-3	2.50	-	-	-	-	-	-	-	-	12	A-2-4 (V)	
HARD, OLIVE BROWN, SILT AND CLAY, SOME SAND, TRACES OF GRAVEL, DAMP	1033.5	5	6	44	22	SS-4	-	-	-	-	-	-	-	-	-	3	A-1-b (V)	
HARD, GRAY, SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, DAMP	1030.5	6	11															
HARD, BROWN, SANDY SILT, WITH COBBLES, DAMP	1028.0	7	6	11	20													
HARD, GRAY, SANDY SILT, SOME CLAY, TRACES OF GRAVEL, WITH WET SAND SEAM, DAMP TO MOIST	1026.0	8	7	32	17	SS-5	4.00	-	-	-	-	-	-	-	-	8	A-6a (V)	
	1021.0	9	11															
		10	12	41	100	SS-6	4.50	-	-	-	-	-	-	-	-	6	A-4a (V)	
		11	7															
		12	11															
		13	18															
		14	50/2"		100	SS-7										9	A-4a (V)	
		15																
		16	25	51	89	SS-8	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)	
		17	17															
		18	19															
		19	50/3"		100	SS-9										14	A-4a (V)	
		20																

NOTES: BORE HOLE CAVE-IN AT 10.0 FT.: SAMPLE SS-3 - <100 PPM SO4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEO\TECHNICAL\14050043\WAP.MOT\F04RTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>6+65, 27.5 RT</u>	EXPLORATION ID <u>B-005-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1039.6 (MSL)</u> EOB: <u>20.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.095428130, -84.636176275</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (6")	1039.6																	
CRUSHED AGGREGATE BASE (6")	1039.1																	
VERY STIFF, RUSTY BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP	1038.6	1	2															
		2	2	6	56	SS-1	3.50	29	19	15	22	15	18	13	5	10	A-4a (0)	
		3	3															
		4	4	10	67	SS-2	3.00	-	-	-	-	-	-	-	-	10	A-4a (V)	
DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, LITTLE SILT, TRACES OF CLAY, DAMP	1035.6	5	5															
	1034.1	6	9	34	17	SS-3	-	37	25	13	17	8	NP	NP	NP	7	A-1-b (0)	
VERY DENSE, BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, DAMP	1032.1	7	8															
		8	16	53	50	SS-4	-	-	-	-	-	-	-	-	-	5	A-2-4 (V)	
		9	25															
HARD, BROWN, SANDY SILT, SOME CLAY, LITTLE GRAVEL, DAMP	1029.6	10	31															
		11	32	89	17	SS-5	-	-	-	-	-	-	-	-	-	9	A-4a (V)	
HARD, GRAY, SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP	1024.1	12	33															
		13	39															
		14	40	111	100	SS-6	4.50	25	19	13	25	18	18	13	5	8	A-4a (2)	
		15	21															
		16	29	77	83	SS-7	-	-	-	-	-	-	-	-	-	8	A-4a (V)	
		17	26															
HARD, GRAY, SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP	1024.1	18	11															
		19	16															
		20	21	52	94	SS-8	4.50	28	18	13	27	14	21	15	6	8	A-4a (1)	
		EOB	8															
	1019.6		14	46	89	SS-9	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)	
			19															

NOTES: BORE HOLE CAVE-IN AT 10.9 FT.: SAMPLE SS-2 - <100 PPM SO4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOTE.FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>10+62, 11.0 RT</u>	EXPLORATION ID <u>B-006-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1045.1 (MSL)</u> EOB: <u>10.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.096511274, -84.636374899</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (4")	1045.1																	
CRUSHED AGGREGATE BASE (8")	1044.8	1	2															
STIFF, DARK BROWN, SANDY SILT, SOME CLAY, TRACES OF GRAVEL, FRIABLE, MOIST	1044.1	2	3	6	56	SS-1	1.50	8	13	15	39	25	24	14	10	19	A-4a (6)	
		3	3															
		4	4	10	50	SS-2	1.50	1	7	17	40	35	25	17	8	19	A-4a (8)	
VERY STIFF, BROWN, SILT AND CLAY, LITTLE SAND, MOIST	1041.1	5	3	6	18	SS-3	2.50	-	-	-	-	-	-	-	-	21	A-6a (V)	
	1039.6	6	9	7														
MEDIUM STIFF, GRAY, SANDY SILT, SOME CLAY, LITTLE GRAVEL, DAMP		7	10	28	28	SS-4	0.50	-	-	-	-	-	-	-	-	12	A-4a (V)	
		8																
VERY STIFF, DARK BROWN, SANDY SILT, SOME GRAVEL, LITTLE CLAY, DAMP	1036.6	9	9	34	28	SS-5	-	-	-	-	-	-	-	-	-	12	A-4a (V)	
	1035.1	10	11	13														
		EOB	10															

NOTES: BORE HOLE CAVE-IN AT 7.0 FT.: SAMPLE SS-1 - <100 PPM SO4  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS



STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOTE.FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>14+34, 14.0 RT</u>	EXPLORATION ID <u>B-007-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>W. FOURTH ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1050.0 (MSL)</u> EOB: <u>10.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.097465335, -84.636370325</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (5")	1050.0																	
CRUSHED AGGREGATE BASE (7")	1049.6	1	2															
STIFF, DARK BROWN, SILT AND CLAY, AND SAND, (FILL), DAMP TO MOIST	1049.0	2	2	7	83	SS-1	2.00	0	29	33	9	29	32	17	15	17	A-6a (2)	
HARD, BROWN, SANDY SILT, SOME CLAY, SOME GRAVEL, (FILL), DAMP	1047.5	3	1	11	42	61	SS-2	4.50	22	17	16	22	23	20	15	5	7	A-4a (2)
MEDIUM DENSE, DARK BROWN, GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY, (FILL), MOIST	1046.0	4	2	4	17	78	SS-3	1.00	-	-	-	-	-	-	-	-	17	A-2-6 (V)
HARD, BROWN WITH GRAY, SANDY SILT, SOME CLAY, LITTLE GRAVEL, WITH COBBLES, DAMP	1044.5	5	5	11	55	56	SS-4	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)
		6																
		7																
		8																
		9	5	9	28	100	SS-5	4.50	-	-	-	-	-	-	-	-	9	A-4a (V)
	1040.0	10	9	11														

EOB

NOTES: BORE HOLE CAVE-IN AT 6.0 FT.: SAMPLE SS-1 - <100 PPM SO4  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOTE.FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>17+76, 14.5 LT</u>	EXPLORATION ID <u>B-008-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>W. FOURTH ST.</u>	PAGE 1 OF 1
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1050.6 (MSL)</u> EOB: <u>10.0 ft.</u>	
START: <u>8/4/14</u> END: <u>8/4/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.098147358, -84.635517441</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (5")	1050.6																	
CRUSHED AGGREGATE BASE (7")	1050.2 1049.6																	
STIFF, DARK GRAY, CLAY, SOME SILT, SOME SAND, TRACES OF GRAVEL, SLIGHTLY ORGANIC (FILL), MOIST	1048.1	1	2	7	72	SS-1	2.00	6	10	15	21	48	53	18	35	25	A-7-6 (17)	
STIFF, GRAY AND BROWN, SILTY CLAY, SOME SAND, SOME GRAVEL, (FILL), MOIST	1046.6	2	3	13	56	SS-2	-	21	12	14	21	32	40	17	23	24	A-6b (9)	
STIFF, BROWN, SILT AND CLAY, SOME SAND, LITTLE GRAVEL, DAMP	1042.6	3	3	32	11	SS-3	1.00	-	-	-	-	-	-	-	-	14	A-6a (V)	
		4	11	69	-	AS-4	-	-	-	-	-	-	-	-	-	14	A-6a (V)	
		5	12															
		6	11															
		7	24															
		8	25															
HARD, BROWN AND GRAY, SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, DAMP	1042.6	9	12	51	100	SS-5	4.50	-	-	-	-	-	-	-	-	8	A-4a (V)	
	1040.6	10	16															
		EOB	20															

NOTES: BORE HOLE CAVE-IN AT 7.0 FT.: SAMPLE SS-1 - <100 PPM SO4

ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOTE.FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>20+85, 11.0 RT</u>	EXPLORATION ID <u>B-009-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>W. FOURTH ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1050.1 (MSL)</u> EOB: <u>10.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/5/14</u> END: <u>8/5/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.098639340, -84.634642415</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (4")	1050.1																	
CRUSHED AGGREGATE BASE (8")	1049.8	1	1															
STIFF, GRAY AND BLACK, CLAY, SOME SAND, LITTLE SILT, LITTLE GRAVEL, (FILL), MOIST	1049.1	2	2	7	39	SS-1	2.00	11	12	17	18	42	54	18	36	25	A-7-6 (15)	
LOOSE, BROWN WITH GRAY, GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT, LITTLE CLAY, (FILL), DAMP	1047.6	3	3	8	100	SS-2	2.50	39	15	13	17	16	22	15	7	10	A-2-4 (0)	
STIFF, DARK BROWN, SILTY CLAY, LITTLE SAND, MOIST	1046.1	4	4	14	22	SS-3	-	-	-	-	-	-	-	-	-	25	A-6b (V)	
STIFF TO VERY STIFF, OLIVE BROWN, SANDY SILT, LITTLE CLAY, TRACES OF GRAVEL, WITH COBBLES, DAMP	1044.6	5	4	6														
		6	6	18	50	SS-4	1.00	-	-	-	-	-	-	-	-	12	A-4a (V)	
		7	7															
		8																
		9	11	31	100	SS-5	4.00	-	-	-	-	-	-	-	-	9	A-4a (V)	
	1040.1	10	11															
		EOB																

NOTES: BORE HOLE CAVE-IN AT 6.5 FT.: SAMPLE SS-2 - 200 PPM SO4  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:29 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOT\FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>24+34, 11.0 RT</u>	EXPLORATION ID <u>B-010-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>W. FOURTH ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1048.7 (MSL)</u> EOB: <u>10.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/4/14</u> END: <u>8/4/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.099272820, -84.633675837</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED	
								GR	CS	FS	SI	CL	LL	PL	PI				
<b>ASPHALT (3")</b>	1048.7																		
<b>CRUSHED AGGREGATE BASE (5")</b>	1048.4	1	3																
LOOSE, BROWN AND WHITE, <b>GRAVEL AND/OR STONE FRAGMENTS</b> , SOME SAND, LITTLE SILT, TRACES OF CLAY, (FILL), DAMP	1048.0	2	3	8	28	SS-1	-	58	15	12	11	4	NP	NP	NP	5	A-1-a (0)		
		3	7	1	4	44	SS-2	-	-	-	-	-	-	-	-	12	A-1-a (V)		
STIFF, BROWN, <b>SANDY SILT</b> , SOME GRAVEL, LITTLE CLAY, DAMP	1044.7	4	3	1	3	56	SS-3	1.00	33	17	12	21	17	22	15	7	13	A-4a (1)	
		5	4	1	3	56	SS-3	1.00	33	17	12	21	17	22	15	7	13	A-4a (1)	
		6	4	2	7	67	SS-4	1.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
MEDIUM DENSE, LIGHT BROWN, <b>GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT</b> , DAMP	1041.7	7	8	2	7	67	SS-4	1.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
		8	7	3	7	67	SS-4	1.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
HARD, BROWN, <b>SANDY SILT</b> , LITTLE CLAY, LITTLE GRAVEL, DAMP	1040.2	9	6	7	20	28	SS-5	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
		10	11	7	20	28	SS-5	-	-	-	-	-	-	-	-	-	9	A-2-4 (V)	
	1038.7	EOB	15	37	-	AS-6	-	-	-	-	-	-	-	-	-	-	-	A-4a (V)	

NOTES: BORE HOLE CAVE-IN AT 8.3 FT.:  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:30 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOT\FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / Z. BEAHR</u>	DRILL RIG: <u>CME 75 TRUCK #25</u>	STATION / OFFSET: <u>26+76, 15.0 LT</u>	EXPLORATION ID <u>B-011-0-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>CME AUTOMATIC</u>	ALIGNMENT: <u>W. FOURTH ST.</u>	
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>3.25" HSA</u>	CALIBRATION DATE: <u>9/24/13</u>	ELEVATION: <u>1047.0 (MSL)</u> EOB: <u>10.0 ft.</u>	PAGE <u>1 OF 1</u>
START: <u>8/4/14</u> END: <u>8/4/14</u>	SAMPLING METHOD: <u>SPT</u>	ENERGY RATIO (%): <u>84.4</u>	COORD: <u>40.099783780, -84.633035885</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	HOLE SEALED
								GR	CS	FS	SI	CL	LL	PL	PI			
ASPHALT (5")	1047.0																	
CRUSHED AGGREGATE BASE (5")	1046.5	1	1															
STIFF, BROWN, CLAY, SOME SILT, LITTLE SAND, TRACES OF GRAVEL, DAMP	1046.1	2	3	8	100	SS-1	1.50	5	8	12	32	43	48	19	29	9	A-7-6 (17)	
		3	3															
		4	3	13	89	SS-2	1.00	-	-	-	-	-	-	-	-	19	A-7-6 (V)	
VERY STIFF, BROWN, SANDY SILT, SOME GRAVEL, SOME CLAY, DAMP TO MOIST	1043.0	5	2															
		6	3	10	100	SS-3	3.00	29	18	10	21	22	24	16	8	12	A-4a (2)	
		7	2															
		8	3	11	56	SS-4	3.50	-	-	-	-	-	-	-	-	13	A-4a (V)	
		9	2															
	1037.0	10	2	6	83	SS-5	-	-	-	-	-	-	-	-	-	17	A-4a (V)	
		EOB	2															

NOTES: SAMPLE SS-2 - 540 PPM SO4  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: PLACED ASPHALT PATCH; USED BENTONITE CHIPS; BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:30 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOT\FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / SB</u>	DRILL RIG: <u>HAND AUGER</u>	STATION / OFFSET: <u>6+05, 34.0 LT</u>	EXPLORATION ID <u>H-004-1-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>MOBILE AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	PAGE 1 OF 1
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>HAND AUGER</u>	CALIBRATION DATE: <u>N/A</u>	ELEVATION: <u>1046.4 (MSL)</u> EOB: <u>7.5 ft.</u>	
START: <u>10/27/14</u> END: <u>10/27/14</u>	SAMPLING METHOD: <u>BULK</u>	ENERGY RATIO (%): <u>60</u>	COORD: <u>40.095181000, -84.636267100</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTH	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			WC	ODOT CLASS (GI)	BACK FILL	
								GR	CS	FS	SI	CL	LL	PL	PI				
TOPSOIL	1046.4																		
VERY STIFF, BROWN, <b>SANDY SILT</b> , SOME CLAY, TRACES OF GRAVEL, WITH BRICK FRAGMENTS MIXED WITH TOPSOIL (FILL), DAMP	1045.9	1																<V> >V<	
	1043.9	2			-	HA-1	2.50	-	-	-	-	-	-	-	10	A-4a (V)		<V> >V<	
HARD, BROWN, <b>SANDY SILT</b> , SOME CLAY, TRACES OF GRAVEL, SLIGHTLY ORGANIC (FILL), DAMP	1042.4	3			-	HA-2	4.50	-	-	-	-	-	-	-	9	A-4a (V)		<V> >V<	
VERY STIFF, BROWN, <b>SANDY SILT</b> , SOME GRAVEL, LITTLE CLAY, (POSSIBLE FILL), DAMP	1039.9	4			-	HA-3	3.25	27	15	17	23	18	21	14	7	10	A-4a (1)		<V> >V<
	1039.9	5			-	HA-4	2.25	-	-	-	-	-	-	-	12	A-4a (V)		<V> >V<	
VERY STIFF, BROWN, <b>SANDY SILT</b> , SOME CLAY, DAMP	1038.9	6			-	HA-5	-	-	-	-	-	-	-	-	10	A-4a (V)		<V> >V<	
	1038.9	7			-	HA-5	-	-	-	-	-	-	-	-	10	A-4a (V)		<V> >V<	

EOB

NOTES: NO GROUNDWATER ENCOUNTERED  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH SOIL CUTTINGS

STANDARD ODOT SOIL BORING LOG (8.5 X 11) - OH DOT.GDT - 11/24/14 16:30 - L:\2014 PROJECT FILES\WAP\PROJECTS\05-GEOTECHNICAL\14050043\WAP.MOT\4 FOURTH\_SWEITZER ST RE

PROJECT: <u>W. FOURTH / SWEITZER ST.</u>	DRILLING FIRM / OPERATOR: <u>CTL ENG / SB</u>	DRILL RIG: <u>HAND AUGER</u>	STATION / OFFSET: <u>6+48, 28.0 RT</u>	EXPLORATION ID <u>H-005-1-14</u>
TYPE: <u>ROADWAY</u>	SAMPLING FIRM / LOGGER: <u>CTL ENG. / R. FOSTER</u>	HAMMER: <u>MOBILE AUTOMATIC</u>	ALIGNMENT: <u>SWEITZER ST.</u>	PAGE 1 OF 1
PID: <u>97246</u> BR ID: <u>N/A</u>	DRILLING METHOD: <u>HAND AUGER</u>	CALIBRATION DATE: <u>N/A</u>	ELEVATION: <u>1043.8 (MSL)</u> EOB: <u>6.5 ft.</u>	
START: <u>10/27/14</u> END: <u>10/27/14</u>	SAMPLING METHOD: <u>BULK</u>	ENERGY RATIO (%): <u>60</u>	COORD: <u>40.095411000, -84.636151000</u>	

MATERIAL DESCRIPTION AND NOTES	ELEV.	DEPTHS	SPT/ RQD	N <sub>60</sub>	REC (%)	SAMPLE ID	HP (tsf)	GRADATION (%)					ATTERBERG			ODOT CLASS (GI)	BACK FILL	
								GR	CS	FS	SI	CL	LL	PL	PI			WC
TOPSOIL	1043.8																	
MEDIUM DENSE, BROWN, <b>GRAVEL AND/OR STONE FRAGMENTS WITH SAND AND SILT</b> , LITTLE CLAY, MIXED WITH TOPSOIL, SLIGHTLY ORGANIC (FILL), DAMP	1043.3	1																<L> >L>
MEDIUM DENSE, BROWN, <b>GRAVEL AND/OR STONE FRAGMENTS WITH SAND, SILT, AND CLAY</b> , WITH ASPHALT AND BRICK FRAGMENTS (FILL), DAMP	1041.3	2			-	HA-1	-	-	-	-	-	-	-	-	11	A-2-4 (V)		<L> >L>
STIFF, BROWN, <b>SANDY SILT</b> , SOME CLAY, LITTLE GRAVEL, (FILL), DAMP	1039.8	3			-	HA-2	4.25	-	-	-	-	-	-	-	12	A-2-6 (V)		<L> >L>
MEDIUM STIFF, BROWN, <b>SILT AND CLAY</b> , SOME SAND, MOIST	1038.3	4			-	HA-3	1.50	11	10	19	34	26	26	17	9	15	A-4a (5)	<L> >L>
	1037.3	5			-	HA-4	0.75	-	-	-	-	-	-	-	15	A-6a (V)		<L> >L>
		6			-													<L> >L>
EOB																		

NOTES: NO GROUNDWATER ENCOUNTERED  
 ABANDONMENT METHODS, MATERIALS, QUANTITIES: BACKFILLED WITH AUGER CUTTINGS

APPENDIX C

**GB1 CALCULATIONS**



**Subgrade Analysis**  
V. 12.00 12/30/11

Global Options		
320	R&R	No
206	CS	Option
	LS	No
	LKD	Option
206	Depth	14

Design CBR **8**

Classification Counts by Sample																	
R	1a	1b	3	3a	2-4	2-5	2-6	2-7	4a	4b	5	6a	6b	7-5	7-6	8a	8b
0	2	3	0	1	7	0	1	0	17	0	0	6	2	0	5	0	0
0%	5%	7%		2%	16%		2%		39%			14%	5%		11%		
32%																	

Surface Class	
2-5	0
4b	0
5	0
7-5	0
7-6	4 36%
8a	0
8b	0
R	0

% Borings	
N <sub>60L</sub> ≤ 5	18%
≤ 10	91%
≥ 20	9%
M+	55%
R	0%

% Surface	
82%	
0%	82%

Rig	ER
A	84
B	
C	
D	
E	
F	
G	
H	

Total Borings	11
PID	97246

Average	N <sub>60</sub>	N <sub>60L</sub>	PI	Clay	M	M <sub>OPT</sub>	GI				
	21.3	8.5	14.1	23.7	12.7	11.3	4.57				
Maximum	69	30	58	21	37	40	50	75	28	18	20
Minimum	3	3	18	13	4	9	4	15	3	6	0

UC @ Surface	
22.0	
30	
18	

Location W. Fourth / Sweitzer St.

#	B #	Boring Location	Depth	To	Cut Fill	Subgrade	Standard Penetration										Physical Characteristics						Moisture		Class		Comments
							n <sub>2</sub>	n <sub>3</sub>	N	Rig	N <sub>60</sub>	N <sub>60L</sub>	LL	PL	PI	% Silt	% Clay	P 200	M	M <sub>OPT</sub>	Ohio DOT	GI					

Problem	
w/ Class	w/ MN

Undercuts	
UC Class	UC MN

Analysis

1	B-001	Sta. 1+07 13.5' Rt of CL N 40.093903 W 84.636004	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.3 5.8	4 5 3 12	1 7 3 15	5 12 6 27	A	7	58 25	21 15	37 10	25 14	50 10	75 24	28 6	18 6	7-6 1b 2-4 4a	20 0 0 5	(fill) (fill) (fill)		N N	21 18
2	B-002	Sta. 3+94 7.0' Lt of CL N 40.094682 W 84.636202	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.4 5.8	2 2 4 4	1 2 4 6	3 4 8 10	A	4	23 21	15 14	8 7	22 22	22 18	44 40	13 12	10 10	4a 4a 4a 2-4	2 5 1 0	(fill)		N N N	30 24 14
3	B-003	Sta. 5+62 14.0' Rt of CL N 40.095138 W 84.636189	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.3 5.8	21 18 15 11	25 20 15 22	46 38 36 33	A	65	20 32	13 18	7 14	15 20	14 17	29 37	8 7	10 14	2-4 6a 6a 3a	0 1 8 0	(fill)			
4	B-004	Sta. 6+05 7.0' Lt of CL N 40.095252 W 84.636274	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.3 5.8	3 11 6 11	3 6 11 20	6 17 17 31	A	8	21 18	14 14	7 4	20 19	17 14	37 33	9 9	10 10	4a 2-4 2-4 1b	0 0 0 0	(fill)		N	18
5	B-005	Sta. 6+65 27.5' Rt of CL N 40.095428 W 84.636176	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.3 5.8	2 4 9 16	2 3 15 22	4 7 24 38	A	6	18 NP	13 NP	5 NP	22 17	15 8	37 25	10 10	10 7	4a 4a 1b 2-4	0 5 0 0			N N	24 15
6	B-006	Sta. 10+62 11.0' Rt of CL N 40.096511 W 84.636375	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.3 5.8	3 4 6 10	1 3 7 10	4 3 13 20	A	6	24 25	14 17	10 8	39 40	25 35	64 75	19 19	10 12	4a 4a 6a 4a	6 8 8 5	(friable)		N N M	24 15
7	B-007	Sta. 14+34 14.0' Rt of CL N 40.097465 W 84.636370	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-0.8	0.2 1.7 3.2 4.7	1.7 3.2 4.7 6.2	2 11 4 11	3 19 8 28	5 30 12 39	A	7	32 20	17 15	15 5	9 22	29 23	38 45	17 7	14 10	6a 4a 2-6 4a	2 2 2 5	(fill) (fill) (fill)		N M	21
8	B-008	Sta. 17+76 14.5' Lt of CL N 40.098147 W 84.635517	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-0.9	0.1 1.6 3.1 4.6	1.6 3.1 4.6 6.1	2 3 12 24	3 6 11 25	5 9 23 49	A	7	53 40	18 17	35 23	21 21	48 32	69 53	25 24	18 16	7-6 6b 6a 6a	17 9 8 8	(fill - slightly organic) (fill)		N MN	21 12
9	B-009	Sta. 20+85 11.0' Rt of CL N 40.098639 W 84.634642	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.1	-0.1 1.4 2.9 4.4	1.4 2.9 4.4 5.9	2 2 4 6	3 4 6 7	5 6 10 13	A	7	54 22	18 15	36 7	18 17	42 16	60 33	25 10	18 10	7-6 2-4 6b 4a	15 0 10 5	(fill) (fill)		N N MN	21 18 12
10	B-010	Sta. 24+34 11.0' Rt of CL N 40.099273 W 84.633676	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.1	-0.1 1.4 2.9 4.4	1.4 2.9 4.4 5.9	3 1 1 2	3 2 3 5	6 3 2 5	A	8	NP 22	NP 15	NP 7	11 21	4 17	15 38	5 13	6 10	1a 1a 4a 4a	0 0 1 5	(fill)		N N N N	--- --- 40 21
11	B-011	Sta. 26+76 15.0' Lt of CL N 40.099784 W 84.633036	1.0 2.5 4.0 5.5	2.5 4.0 5.5 7.0	-1.2	-0.2 1.3 2.8 4.3	1.3 2.8 4.3 5.8	3 3 3 3	3 6 4 5	6 9 7 8	A	8	48 24	19 16	29 8	32 21	43 22	75 43	9 19	18 18	7-6 7-6 4a 4a	17 14 2 5			N N	18 15 14

APPENDIX D

**WALL CALCULATIONS**

**B-004-0-14: STA. 6+00; LEFT (WEST) WALL**

## BEARING RESISTANCE CALCULATION

W. Fourth / Sweizer St Reconstruction: PID #97246

CTL Project No.: 14050043WAP

Date: August 29, 2014

Strength Limit State Design

**Boring: B-004-0-14 Sta. 6+00; Left Wall (West Side)**

**Wall Details:**

Estimated Wall Top Elevation	=	1045.1	feet	from plans
Estimated Bottom Wall Elevation	=	1041.3	feet	from plans
Estimated Subgrade Elevation	=	1038.3	feet	from plans
Estimated Height of Wall, H	=	6.8	feet	from plans
Estimated Retained Soil Height, h	=	8.8	feet	see attached
Estimated Width of Reinforced Soil (0.70H), L	=	8.0	feet	from plan notes
Estimated Width of Reinforced Soil & Wall, B	=	9.0	feet	from plans
Estimated Length of Wall, L <sub>w</sub>	=	265.5	feet	from plans

**Reinforced Soil (SGB):**

Friction Angle of Reinforced Fill, $\phi_{rein}$	=	34	degrees	ODOT CMS SS840
Unit Weight of Reinforced Soil, $\gamma_{rein}$	=	120	pcf	ODOT CMS SS840
Active Pressure of Reinforced Fill, $K_{a,rein}$	=	0.283		$= (1 - \sin \phi_{rein}) / (1 + \sin \phi_{rein})$

**Retained Soil:**

Soil Type	=	A-6a		from NRCS Soil Survey (MmB)
Surcharge Slope Angle, $\beta$	=	14	degrees	from plans
Friction Angle of Retained Soil, $\phi_{ret}$	=	30	degrees	GB6 Table 1, PI=15
Unit Weight of Retained Soil, $\gamma_{ret}$	=	125	pcf	NAVFAC, DM-7.1
Active Pressure of Retained Soil, $K_{a,ret}$	=	0.333		$= (1 - \sin \phi_{ret}) / (1 + \sin \phi_{ret})$

**Foundation Soil:**

Soil Type	=	A-4a		from borings
Friction Angle of Bearing Soil, $\phi_f$	=	0	degrees	(undrained Condition)
Cohesion of Bearing Soil, $c^{**}$	=	1760	psf	see below
Unit Weight of Bearing Soil, $\gamma_f$	=	120	pcf	NAVFAC, DM-7.1

**Unfactored Loads:**

Reinforced Soil Mass Vertical Force, $V_1$	=	6.53	Kip/ft.	see attached
Backslope Soil Mass Vertical Force, $V_2$	=	1.91	Kip/ft.	see attached
Retained Soil Mass Vertical Force, $F_V$	=	0.37	Kip/ft.	see attached
Total Vertical Force, V	=	8.82	Kip/ft.	see attached
Retained Soil Mass Horizontal Force, $F_H$	=	1.50	Kip/ft.	see attached

**Bearing Resistance Calculation:**

$$q_n = cN_c S_c i_c + \gamma_{ret} D_f N_q s_q d_q i_q C_{wq} + 0.5 \gamma_f B N_\gamma s_\gamma i_\gamma C_{w\gamma}$$

(AASHTO LRFD Eqs. 10.6.3.1.2a-1, 10.6.3.1.2a-2, 10.6.3.1.2a-3, and 10.6.3.1.2a-4)

$N_c$	=	5.14		AASHTO LRFD Table 10.6.3.1.2a-1
$S_c$	=	1.01		AASHTO LRFD Table 10.6.3.1.2a-3
$i_c$	=	1.00		AASHTO LRFD Eqn 10.6.3.1.2a-5,6
$D_f$	=	3.00		from plans
$N_q$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-1
$s_q$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-3
$i_q$	=	1.00		AASHTO LRFD Eqn 10.6.3.1.2a-5,6
$d_q$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-4
$C_{wq}$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-2
$N_\gamma$	=	0.00		AASHTO LRFD Table 10.6.3.1.2a-1
$s_\gamma$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-3
$i_\gamma$	=	1.00		AASHTO LRFD Eqn 10.6.3.1.2a-8
$C_{w\gamma}$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-2

Nominal Bearing Resistance, $q_n$	=	9.48	ksf	
Resistance Factor, $\phi_b$	=	0.45		AASHTO LRFD Table 10.5.5.2.2-1
Factored Bearing Resistance, $q_{fn}$	=	4.27	ksf	

**\*\*Cohesion Calculation**

$$c = f_1 N_{60} p_a / 100, \text{ psf}$$

$f_1$	=	5.5		(FHWA GEC No. 5, Table 33)
$N_{60}$	=	16	bpf	(FHWA GEC No. 5, Table 33)
$p_a$	=	2000	psf	From Boring Log (8+24)/2=16
$c$	=	1760	psf	atmospheric pressure value
				(undrained)

## SETTLEMENT PARAMETERS

W. Fourth / Sweizer St Reconstruction: PID #97246

CTL Project No.: 14050043WAP

Date: August 29, 2014

Service Limit State Design

Boring: B-004-0-14 Sta. 6+00; Left Wall (West Side)

Layer No.	Top Elev.	Bottom Elev.	Thickness, ft.	Type	Total Unit Weight, pcf	Eff. Vertical Stress ( $p_o$ ), psf	N60 value, bpf	Moisture Content (w), %	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Specific Gravity ( $G_s$ )	Liquidity Index (LI) = $(w-PL)/PI^{(1)}$	Hough Bearing Capacity Index $^{(1)}$	Cr = $w/1000^{(1)}$	$e_o = G_s w/100^{(1)}$	$\Delta q_s$ , psf	Final Vertical Stress ( $p_f$ ), psf = $p_o + (\Delta q_s + 2200)^{(2)}$	Settlement ( $Sc$ ) $^{(3)}$ , in.
A	1041.0	1038.5	2.5	A-4a	120.0	150.0	8	9	21	14	7	2.68	-0.71	--	0.009	0.24	0.99	2328.0	0.26
B	1038.5	1035.5	3.0	A-2-4	130.0	495.0	24	11	18	14	4	2.68	-0.75	0.013	--	0.29	0.85	2365.0	0.31
C	1035.5	1033.5	2.0	A-1-b	130.0	820.0	44	3	NP	NP	NP	2.65	NP	0.007	--	0.08	0.71	2382.0	0.08
D	1033.5	1030.5	3.0	A-6a	135.0	1152.5	32	8	32	18	14	2.68	-0.71	--	0.008	0.21	0.57	2406.5	0.08
E	1030.5	1028.0	2.5	A-4a	140.0	1530.0	41	6	20	14	6	2.68	-1.33	--	0.006	0.16	0.43	2476.0	0.03
F	1028.0	1026.0	2.0	A-4a	140.0	1845.0	46	9	20	14	6	2.68	-0.83	--	0.009	0.24	0.29	2483.0	0.02
G	1026.0	1021.0	5.0	A-4a	140.0	2335.0	51	14	20	14	6	2.68	0.00	--	0.014	0.38	0.15	2665.0	0.04
H																			
I																			
J																			
K																			
L																			
M																			

Total Estimated Consolidation Settlement $^{(4)}$ : 0.81

Notes / Reference Key

- (1) FHWA NHI Course No. 13212
- (2) 2,200 psf is the Factored Bearing Resistance obtained from B-005-0-14
- (3) FHWA NHI Course No. 13212  $Sc = \Delta H * C_r / (1 + e_o) * \log(p_f / p_o)$
- (4) Please note Calculations are based on soils encountered in borings that were drilled at locations outside of the proposed wall, not actual soil conditions beneath the existing embankment. Soils under the existing embankments are anticipated to be more consolidated than what is reflected by these calculations; hence, these values should be considered as conservative in regards to actual settlement anticipated.

**B-005-0-14: STA. 6+50; RIGHT (EAST) WALL**

## BEARING RESISTANCE CALCULATION

W. Fourth / Sweizer St Reconstruction: PID #97246

CTL Project No.: 14050043WAP

Date: August 29, 2014

Strength Limit State Design

**Boring: B-005-0-14 Sta. 6+50; Right Wall (East Side)**

**Wall Details:**

Estimated Wall Top Elevation	=	1043.2	feet	from plans
Estimated Bottom Wall Elevation	=	1039.7	feet	from plans
Estimated Subgrade Elevation	=	1036.7	feet	from plans
Estimated Height of Wall, H	=	6.5	feet	from plans
Estimated Retained Soil Height, h	=	8.4	feet	see attached
Estimated Width of Reinforced Soil (0.70H), L	=	8.0	feet	from plan notes
Estimated Width of Reinforced Soil & Wall, B	=	9.0	feet	from plans
Estimated Length of Wall, Lw	=	265.5	feet	from plans

**Reinforced Soil (SGB):**

Friction Angle of Reinforced Fill, $\varphi_{rein}$	=	34	degrees	ODOT CMS SS840
Unit Weight of Reinforced Soil, $\gamma_{rein}$	=	120	pcf	ODOT CMS SS840
Active Pressure of Reinforced Fill, $K_{a,rein}$	=	0.283		$= (1 - \sin \varphi_{rein}) / (1 + \sin \varphi_{rein})$

**Retained Soil:**

Soil Type	=	A-6a		from NRCS Soil Survey (MmB)
Surcharge Slope Angle, $\beta$	=	14	degrees	from plans
Friction Angle of Retained Soil, $\varphi_{ret}$	=	30	degrees	GB6 Table 1, PI=15
Unit Weight of Retained Soil, $\gamma_{ret}$	=	125	pcf	NAVFAC, DM-7.1
Active Pressure of Retained Soil, $K_{a,ret}$	=	0.333		$= (1 - \sin \varphi_{ret}) / (1 + \sin \varphi_{ret})$

**Foundation Soil:**

Soil Type	=	A-4a		from borings
Friction Angle of Bearing Soil, $\varphi_f$	=	0	degrees	(undrained Condition)
Cohesion of Bearing Soil, $c^{**}$	=	880	psf	see below
Unit Weight of Bearing Soil, $\gamma_f$	=	120	pcf	NAVFAC, DM-7.1

**Unfactored Loads:**

Reinforced Soil Mass Vertical Force, $V_1$	=	6.19	Kip/ft.	see attached
Backslope Soil Mass Vertical Force, $V_2$	=	1.91	Kip/ft.	see attached
Retained Soil Mass Vertical Force, $F_V$	=	0.35	Kip/ft.	see attached
Total Vertical Force, V	=	8.45	Kip/ft.	see attached
Retained Soil Mass Horizontal Force, $F_H$	=	1.38	Kip/ft.	see attached

**Bearing Resistance Calculation:**

$$q_n = cN_c s_c i_c + \gamma_{ret} D_f N_q s_q d_q i_q C_{wq} + 0.5 \gamma_f B N_\gamma s_\gamma i_\gamma C_{w\gamma}$$

				(AASHTO LRFD Eqs. 10.6.3.1.2a-1, 10.6.3.1.2a-2, 10.6.3.1.2a-3, and 10.6.3.1.2a-4)
$N_c$	=	5.14		AASHTO LRFD Table 10.6.3.1.2a-1
$s_c$	=	1.01		AASHTO LRFD Table 10.6.3.1.2a-3
$i_c$	=	1.00		AASHTO LRFD Eqn 10.6.3.1.2a-5,6
$D_f$	=	3.00		from plans
$N_q$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-1
$s_q$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-3
$i_q$	=	1.00		AASHTO LRFD Eqn 10.6.3.1.2a-5,6
$d_q$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-4
$C_{wq}$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-2
$N_\gamma$	=	0.00		AASHTO LRFD Table 10.6.3.1.2a-1
$s_\gamma$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-3
$i_\gamma$	=	1.00		AASHTO LRFD Eqn 10.6.3.1.2a-8
$C_{w\gamma}$	=	1.00		AASHTO LRFD Table 10.6.3.1.2a-2

Nominal Bearing Resistance, $q_n$	=	4.93	ksf	
Resistance Factor, $\phi_b$	=	0.45		AASHTO LRFD Table 10.5.5.2.2-1
Factored Bearing Resistance, $q_{fn}$	=	2.22	ksf	

**\*\*Cohesion Calculation**

$$c = f_1 N_{60} p_a / 100, \text{ psf}$$

$f_1$	=	5.5		(FHWA GEC No. 5, Table 33)
$N_{60}$	=	8	bpf	(FHWA GEC No. 5, Table 33)
$p_a$	=	2000	psf	From Boring Log (6+10)/2=8
$c$	=	880	psf	atmospheric pressure value (undrained)

## SETTLEMENT PARAMETERS

W. Fourth / Sweizer St Reconstruction: PID #97246

CTL Project No.: 14050043WAP

Date: August 29, 2014

Service Limit State Design

Boring: B-005-0-14 Sta. 6+50; Right Wall (East Side)

Layer No.	Top Elev.	Bottom Elev.	Thickness, ft.	Type	Total Unit Weight, pcf	Eff. Vertical Stress ( $p_o$ ), psf	N60 value, bpf	Moisture Content (w), %	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)	Specific Gravity ( $G_s$ )	Liquidity Index (LI) = $(w-PL)/PI^{(1)}$	Hough Bearing Capacity Index $^{(1)}$	Cr = $w/1000^{(1)}$	$e_o = G_s w/100^{(1)}$	$\Delta q_s$ , psf	Final Vertical Stress ( $p_f$ ), psf = $p_o + (\Delta q_s * 2200^{(2)})^{(1)}$	Settlement ( $Sc$ ) $^{(3)}$ , in.
A	1039.6	1035.6	4.0	A-4a	120.0	240.0	8	10	18	13	5	2.68	-0.60	--	0.01	0.27	0.99	2418.0	0.38
B	1035.6	1034.1	1.5	A-1-b	130.0	577.5	34	7	NP	NP	NP	2.65	NP	0.008	--	0.19	0.82	2381.5	0.09
C	1034.1	1032.1	2.0	A-2-4	130.0	805.0	53	5	18	14	4	2.68	-2.25	--	0.005	0.13	0.65	2235.0	0.05
D	1032.1	1029.6	2.5	A-4a	135.0	1103.8	89	9	32	18	14	2.68	-0.64	--	0.009	0.24	0.49	2181.8	0.06
E	1029.6	1024.1	5.5	A-4a	140.0	1657.5	94	8	20	14	6	2.68	-1.00	--	0.008	0.21	0.32	2361.5	0.07
F	1024.1	1019.6	4.5	A-4a	140.0	2357.5	49	9	20	14	6	2.68	-0.83	--	0.009	0.24	0.15	2687.5	0.02
G																			
H																			
I																			
J																			
K																			
L																			
M																			

Total Estimated Consolidation Settlement $^{(4)}$ : 0.67

Notes / Reference Key

- (1) FHWA NHI Course No. 13212
- (2) 2,200 psf is the Factored Bearing Resistance
- (3) FHWA NHI Course No. 13212  $Sc = \Delta H * C_r / (1 + e_o) * \log(p_f / p_o)$
- (4) Please note Calculations are based on soils encountered in borings that were drilled at locations outside of the proposed wall, not actual soil conditions beneath the existing embankment. Soils under the existing embankments are anticipated to be more consolidated than what is reflected by these calculations; hence, these values should be considered as conservative in regards to actual settlement anticipated.